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THE

POLYTECHNIC REVIEW AND MAGAZINE.

AGRICULTURAL CHEMISTRY.

ON THE IMPORTANCE OF AGRICULTURAL CHEMISTRY TO PRACTICAL FARMERS, WITH A HISTORICAL SKETCH OF ITS RISE AND PROGRESS, AND THE MODE IN WHICH IT MAY BE STUDIED.

IN walking over a meadow where both cows and horses have pastured, the very striking difference produced on the grass by the droppings of each is apparent to the most careless observer. Around the horse droppings the herbage is usually yellowish, or parched, similar to the tufts of grass on gravel walks which have been purposely sprinkled with boiling water, in order to kill them. It seems therefore but fair to infer, that the horse droppings have diffused into the soil around them something which has a similar effect to boiling water in discolouring the grass.

Around the droppings of the cows, on the other hand, the grass is more luxuriant, and of a finer green than in any other part of the field; similar to the irregular green rings of fine grass which may be seen in lanes encircling the spots where a party of Gypsies have had a fire. In this case, also, it would at first sight seem fair to infer, that the greater luxuriance of the herbage around the cows' droppings and the Gypsies' fire-place might arise from a similar cause, as the effects seem so similar; and so it has been and is thought by many observers, and so it is set down in some books on tillage. Yet, plausible as the view seems, that the increased luxuriance is owing to an increased supply of food,—in the one case to the manure of cow-dung, and in the other to the manure of ashes or charcoal,—closer investigation proves the inference to be far from correct, and might (although it did not) have led to the discovery of one of the leading and incontrovertible principles upon which the science of agriculture rests.

Reverting to the fact of the horse droppings discolouring the grass, inasmuch as the effect takes place to some distance, it must either be caused by the diffusion of some liquid, some

vapour, or both, emanating from the dung which is not in contact with the discoloured grass. Now, in order to discover the nature of the emanations, whatever they may be, it will be indispensable to examine the component parts of the dung, and the changes it may undergo by exposure to air, sunshine, or rain. In its mechanical texture it differs most materially from cow-dung, being comparatively dry, husky, and usually intermixed with a considerable portion of undigested matter, owing to the horse not chewing the cud like the cow, and hence not having so great a power of thorough digestion. But the greatest comparative difference can only be discovered by a chemical examination, or, as it is termed, *analysis* of the various constituents, by which means both the solids, the fluids, and the vapours contained in it can be separated and individually examined. In this way, it will be found that the horse-dung, after being dropped, if the weather is at all warm, will undergo fermentation, and give off during the process a compound vapour, consisting of a large proportion of the pungent and acrid matter termed by chemists ammonia, but popularly called spirits of hartshorn. It follows that this compound ammoniacal vapour will be partially diffused into the soil around, even in dry weather, and may thus tend to discolour the grass; but when warm summer showers fall, the constituents of the vapour will become mixed with the rain water, and with it will soak into the soil, scorching the herbage at the root, and poisoning the grass wherever it reaches.

From this statement, then, it is very obvious, that though the fact of the horse droppings discolouring the grass is remarkable enough, the cause is discoverable neither by inspection nor by reasoning, and can only be traced by a knowledge and practical application of chemistry.

In the instance again of the cow's droppings improving the herbage, as the effect also takes place to some distance, it must either be caused by the diffusion of some liquid, some vapour, or both, emanating from the dung, not in contact with the improved grass. Here, likewise, recourse must be had to chemical examination or analysis. In its mechanical texture it differs materially from horse-dung, being greatly more moist, darker coloured, and more uniform throughout its mass, while little or no undigested matters are observable, owing to the more thorough digestion caused by chewing the cud. In chemical composition it differs still more, having but a small proportion of the acrid ammoniacal vapour, and a considerable proportion of a dark-coloured matter, composed of what chemists term carbon, or pure charcoal, combined with certain gases and certain solid materials. It is, indeed, in many particulars similar to horse-dung which has undergone the process of fermentation, usually termed rotted dung, and which is proved (in contradiction to some theoretical fancies,) to be one of

the richest of known manures. In the same way, then, as the dark-coloured drainings from dunghills, when permitted to soak into the soil around them, render the herbage more luxuriant and green, do showers falling upon cows' droppings carry into the soil around, the dark-coloured carbonaceous matter, rich in vegetable nourishment.

It would be practically erroneous, however, to infer from these facts, that cow-dung is in all cases superior to horse-dung, the very contrary being indisputable; but the horse-dung, to be rendered superior, bulk for bulk, must undergo in the dunghill or the compost heap, a process of digestion, (if it may be so termed,) in order to make up for its previous less thorough digestion, than is effected by the intestinal organs of cows. The chemical agriculturist must therefore take care always to compare his facts, analyses, and inferences with the facts and inferences of the practical farmer; otherwise he may overlook some circumstance of the utmost importance to the correctness of the results. This may be made still more obvious by adverting to the effects of the Gypsies' fire on the surrounding grass.

It has already been mentioned, that it would be far from correct to ascribe the improved luxuriance and verdure of the herbage around the droppings of cows, and around the Gypsies' fire, to the same cause, namely, a supply of carbonaceous matter. That the ashes produced by the fire form an excellent manure, will not be disputed; but when the very small quantity of such ashes is taken into consideration, fires being rarely lit more than once on the same spot by those restless vagabonds, their effect on the grass, on which they can only be scattered accidentally and in patches, will not account for the regular halo of brighter green around the fire-place, the verdure gradually shading off into the common duller colour of the general sward. By examining the effects which the fire must produce, however, we may attain some approximation to the truth.

When a Gypsy's fire is lit on the green sward, the first effect on the turf is the burning up of the whole herbage within its focus; but, immediately beyond this, the heat can only penetrate to a small extent beneath the surface, and the temperature must diminish with the distance from the fire. Now, the fluids in the soil around the fire having their temperature raised, will, in consequence, be proportionally evaporated, leaving the soil more dry, and consequently more ready to imbibe fresh moisture from the next rains; and no farmer requires to be told that nothing is more beneficial to a growing crop than the effectual removal of old or stagnant moisture, followed by a supply of what is fresh. But the cause of this effect of the removal of old, and its replacement by fresh moisture, is not so obvious, and is but of recent discovery, it having been found by chemical and physiological experiment that the water or moisture which remains long about the roots of growing plants, becomes

impregnated with the excrementitious discharges of those plants, and of course is as injurious and poisonous to their growth, as would be the droppings of cows and horses to these animals, were they compelled to feed thereupon, even although it were mixed with good food, as the excrementitious discharges of growing plants into the soil in most cases must be. Now it is obvious, that the Gypsies' fire, in evaporating the moisture from the surrounding soil, must, at the same time, evaporate the excrementitious matter with which it is loaded. The roots of the grass are consequently freed from the presence of this poisonous matter, at the same time that the soil is rendered dry and greedy of the next fresh moisture, which may be deposited there in the form of dew or rain.

All this, then, is most satisfactorily and clearly explicable, but without the aid of chemistry, no practical farmer could give any rational account of the very different effects of the droppings of horses and cows, much less of the effects of the Gypsies' fires.

These three familiar illustrations have been chosen by way of introduction, to awaken the attention of the reader to the paramount importance of chemical inquiry to the agriculturist, a circumstance the more necessary, that some practical writers of the highest authority denounce chemistry as only calculated to mislead the farmer from the real path of improvement and prosperity. The following is a specimen of the anti-chemical, and, what is no less remarkable, the anti-physiological spirit of several standard practical authors.

As the cultivation of growing crops consists in supplying them with a due portion of proper food in the most beneficial manner, the ascertaining the kinds and qualities of that food must always be the fundamental study of the farmer. On the contrary, Mr. Brown of Markle, in the excellent practical article on Agriculture in Brewster's Edinburgh Encyclopædia, says, " How numerous and diversified are the sentiments of theorists concerning the food of plants, a subject not to be comprehended by the human mind in its present state. We are disposed to consider disquisitions respecting the food of plants, and even concerning the principles of vegetation, as quite foreign to a treatise on agriculture. The operative farmer could not, therefore, be benefited in the smallest degree, nor would any part of his practice be illustrated or improved. Perhaps, on the contrary, he might be led out of the right path, into a vortex of delusion."

Now this is very extraordinary as coming from a writer of Mr. Brown's intelligence and good sense, though illustrations, as we shall afterwards see, may be readily found to justify no small portion of his opinion, which, however, must not be taken unconditionally, but as applicable to fanciful theories only; since he himself virtually turns round to the opposite side in

his very next paragraph. "Yet," says he, "we are inclined to believe that a degree of certainty is already attained concerning the real theory of the art. If the earth is enriched by generous manures" [only another term for the so-called incomprehensible food of plants] "or stimulated by powerful cordials, as circumstances may require," &c.; and then he goes on to give his *real* theory, which is, "First, that the soil ought to be kept dry, or, in other words, free of all superfluous moisture. Secondly, that it ought to be kept clean, or, in other words, free of all superfluous weeds" [with the more injurious excrementitious discharges of plants he was unacquainted]. "Thirdly, that it ought to be kept rich, or, in other words, that every particle of manure" [meaning nourishing food] "which can be collected ought to be applied:" and farther on he somewhat tardily and reluctantly admits, that in his third principle, "the utility of chemical knowledge may, in some respects, be estimated and recognised."

It will be quite sufficient to silence every objector to the study of agricultural chemistry who holds similar opinions with Mr. Brown, to ask how the most "generous manures," or "powerful cordials," by which land "ought to be kept rich," are to be tested and valued, except by chemistry in conjunction with physiological experiment or practical experience? We must admit (for there is no avoiding it) that theorists, and particularly chemical theorists, have in but too many instances misled such practical farmers as implicitly followed them, without first well weighing the probable results in a practical balance: but these erroneous theories ought no more to forbid the study in question, than the erroneous theories in medicine and astronomy previous to Harvey and Newton ought to have forbid the studies which have led to so great practical utility in surgery, in navigation, and the arts connected with them.

The knowledge of what is best to be done in practice, is the knowledge of the reasons why one mode is better than another mode. Now *these reasons are in fact the science,* and the farmer who does not know a good and satisfactory reason beyond use and wont, or hap-hazard experience, for adopting a certain rotation of crops; for liming one sort of soil and not liming another sort; for planting or sowing thinly rather than closely; and, in short, for all his various processes and operations, must be pronounced to know little more than half his own business. Ask any farmer, prejudiced against science and books, what has spread the red rust over his wheat, and he will tell you, with the utmost confidence, that it came from a barberry bush in the hedge, though it is scientifically demonstrable, that the barberry bush has no more to do with it than if it had been growing at Botany Bay. Ask him why wide sowing produces heavier crops than close sowing, and he will tell you it is because the plants have more room and more air—good things in

their way, certainly, but only secondary to the powerful influence of the sun's light, a principle of which the non-chemical and non-reading farmer would never dream, but without which all the air and room in the world would not make the plants grow healthily for one week.

So recently as the middle of the last century no work had appeared in which any chemical principles had been applied to agriculture, and even M. Duhamel, in France, one of the most intelligent writers of the age, adopted, in 1754, the system published twenty years previously by Jethro Tull, who maintained the obviously erroneous doctrine that as plants feed on minute earthy particles, all manure is superfluous, and the whole business of the farmer ought to consist in pulverizing the soil by horse-hoeing. Duhamel, however, lived to renounce these opinions, and Sir Humphrey Davy proved, by direct experiments, that plants cannot admit the most minute solid particle, either of earth or any thing else, as might have been physiologically foreseen, for though the tips of the root fibres permit fluids to pass through them into the plant, as a bit of bladder will allow fluids to pass through it, as recently explained by M. Dutrochet, yet no pores can be detected there by the most powerful microscopes. That the doctrine of Tull, notwithstanding these clear demonstrations of its error, is again and again partially revived, and at this hour believed in by many practical men, is one among the many reasons why a knowledge of sound agricultural chemistry should be diffused.

The year after the publication of Duhamel's work, the Edinburgh Society for the improvement of Arts and Manufactures, proposed a gold medal "for the best dissertation on vegetation and the principles of agriculture." This was awarded to Dr. F. Home, whose essay may be considered the first important work on the chemistry of agriculture. In the third edition of this work, (8vo, London, 1762,) now before us, Dr. Home says, "Husbandry does not, like most arts, lead to an account of itself; or depend on principles which its practice can teach. Something beyond this art is necessary to the knowledge of the art itself. The principles of all external arts must be deduced from mechanics or chemistry. Agriculture is in the last class; and though it depends very much on the powers of machinery, yet I 'll venture to affirm, that it has a greater dependence on chemistry. Without a knowledge in the latter science, its principles can never be settled. As this science is but of late invention, and has not yet been cultivated with that regard to utility and the improvement of trades and manufactures, as it ought and might, agriculture is hardly sensible of its dependence on it.

"The design," he adds, "of the following sheets is to make this appear; and to try how far chemistry will go in settling the principles of agriculture. I don't intend in the following

remarks to settle facts, or teach the practical part of farming. That I leave to farmers. My design is only to sketch out the great outlines of this art, and show, that it is capable of being reduced, like others, to a regular system. If in this way we can fix some settled principles from the facts which are already ascertained, those who apply to practice will find the benefit in it. The just theory of an art leads directly to its improvement, as it leads to those experiments which yet remain to be tried. Without this guide, we may stumble on truths by accident; but when led by it, we have the secret satisfaction of thinking, that we are indebted to ourselves for the happy issue of the experiment."

We have given the preceding remarks at length, because they are now as correct as when first published nearly a century ago, and by following them out in experiment with considerable sagacity, notwithstanding the infant state of chemistry at that time, Dr. Home may be justly said to have laid the foundation of agricultural chemistry; and this was partially followed by Lord Kaims in his Gentleman Farmer published in 1776, a work which may be considered as one great source of the superiority of Scotland in practical farming. Lord Kaims's design being different from Dr. Home's, has only a portion devoted to chemical subjects, but its greater popularity tended to diffuse the knowledge, still very imperfect, in that line of study.

The continental authors on rural affairs about this period far exceeded those of our own country in voluminous works, such as the *Cours d'Agriculture* now on our table in twelve volumes quarto, edited by the celebrated Abbé Rozier, assisted by Parmentier, Tillet and others: but though in this and other foreign agricultural publications occasional notice is taken of chemical subjects applicable to cultivation, we are not aware of any work like that of Dr. Home expressly devoted to the subject. Rozier is a violent opposer of the process of fallowing. In 1795, twenty-one years after the appearance of Lord Kaims's Gentleman Farmer, the late ingenious Earl of Dundonald published his well known treatise on the intimate connexion between agriculture and chemistry, without being aware, so far as we can judge, of the existence of Dr. Home's work. "The slow progress," remarks Lord Dundonald, "which agriculture has hitherto made as a science, is to be ascribed to a want of education on the part of the cultivators of the soil, and the want of knowledge, in such authors as have written on agriculture, of the intimate connexion that subsists between this science and that of chemistry. Indeed, there is no operation or process not merely mechanical, that does not depend on chemistry." And he goes on to say that "in the following pages, an attempt will be made to explain, on established principles, the processes which accompany the cultivation and amelioration of the soil." "By the adoption of a new line of investigation, exemplified

in the following treatise, light has not only been thrown on the action and effects of the manures at present employed, but the uses of other substances and methods of combining and preparing them have been discovered; from which there are just grounds to believe a valuable addition will accrue to the present stock of agricultural knowledge.

"It will appear," continues his lordship, "that the saline and other substances capable of being applied to promote vegetation, are very numerous; by far the greater part of them have escaped the notice of those who have made agriculture their study, nor have any attempts even been made to explain on chemical principles the operation of the manures and substances now in use. Had such researches been prosecuted to effect, they would have led to the discovery and application of other substances capable of being employed with equal or perhaps superior advantage."

About the same period Dr. Darwin published his Phytologia, which, together with some of his own fanciful or rather poetical views of the science of vegetation, including the chemistry of manures, embodied many of the most important discoveries of Bonnet, Sennebier, Saussure and other continental authors of celebrity, collected with considerable learning and industry, and ingeniously brought in to support his peculiar opinions. It is doubtful, however, whether this singularly clever book had much influence in diffusing a taste for the study of agricultural chemistry any more than Kirwan's Essay on Manures, published about the same time.

One of the most important events in the history of agricultural chemistry was the analysis, in 1800, of magnesian limestone by Tennant. This limestone, forming the sub-soil about Belfast, and in some of the northern counties of England, renders the soil peculiarly sterile, owing, perhaps, to the insolubility of the magnesia; but previous to Tennant's analysis, it was not known what rendered this peculiar limestone so injurious to lands, while other limestones on the contrary contribute to fertility.

In 1802, Sir Humphrey Davy was appointed to deliver an annual course of chemical lectures before the Board of Agriculture; and in 1813, these lectures were given to the public, and together with sound chemistry, and some good elucidations of its applicability to agriculture, contain some very remarkable practical errors and oversights, particularly in the instance of the important process of fallowing, of which, he says, "it is scarcely possible to imagine a single instance of a cultivated soil that can be supposed to remain fallow a year with advantage to the farmer." And in the no less extraordinary instance of dung, of which he says, "dung that has fermented, so as to become a mere soft cohesive mass, has generally lost from one third to one half of its most useful constituent elements, and

should evidently be applied as soon as fermentation begins, that it may exert its full action upon the plant, and lose none of its nutritive powers;"—doctrines in direct opposition to the universal experience of practical men, from Virgil and Columella down to the present time. Had this eminent chemist, however, lived to become acquainted with the experiments of Macaire, Sprengel and Boullay, he would no doubt have been the first to abandon what the imperfection of science at that time had led him to consider as sound doctrine. His views of the dependence of agriculture on chemistry are judicious, and worthy of being quoted.

"It is scarcely possible," he remarks, "to enter upon any investigation in agriculture, without finding it connected more or less with doctrines or elucidations derived from chemistry. If land be unproductive, and a system of ameliorating it is to be attempted, the sure method of obtaining the object is by determining the cause of its sterility, which must necessarily depend upon some defect in the constitution of the soil, which may be easily discovered by chemical analysis. Some lands, of good apparent texture, are yet sterile in a high degree, and common observation and common practice afford no means of ascertaining the cause or removing the effect. The application of chemical tests in such cases is obvious; for the soil must contain some noxious principle, which may be easily discovered, and probably easily destroyed. Are any of the salts of iron present? They may be decomposed by lime. Is there any excess of siliceous sand? The system of improvement must depend on the application of clay and calcareous matters. Is there a defect of calcareous matter? The remedy is obvious. Is an excess of vegetable matter indicated? It may be removed by liming, paring and burning. Is there a deficiency of vegetable matter? It is to be supplied with vegetable manure."

Such are a few of the views of this great chemist on the subject of agricultural chemistry, and they have been adopted either implicitly or with some modification by many writers and compilers of agricultural works in this country.

In 1810, M. Thaër published at Berlin his Elements of Rational Agriculture [a], which, in soundness of chemical views, far surpasses any English publication on agriculture. He considers the food of plants to consist of a substance which, following Rozier and Parmentier, he terms *humus*, the Latin word for "soil," and describes this humus to be a dark, unctuous, pliant, and apparently homogeneous substance, composed of oxygen, hydrogen, carbon, and nitrogen or azote; and being the result of the slow decomposition of organic matter, it is found in well-rotted dung, as well as in rich loamy soils, as a principal constituent. On being brought into contact with at-

[a] Grundsätze der Rationellen Landwirthschaft, 4 vols. 4to.

mospheric air, part of the carbon of this humus unites with oxygen, forming carbonic acid gas, while a portion of its hydrogen also, with oxygen, forms water, the residue consisting of what M. Thaër terms an extract, being dissolved in the water and taken up into plants through their roots.

No work of much superiority appeared in this country connected with the subject of agricultural chemistry since the publication of Sir H. Davy's, until the views of Liebig were unfolded, unless we except the deservedly celebrated volume of Sir Henry Steuart, entitled the "Planter's Guide," a volume, however, which only incidentally embraces subjects connected with agricultural chemistry, as a part of the profound scientific views and practical experience of the highly talented author.

A work on the subject it may be necessary to mention here, is De Candolle's Physiologie Vegetale, many of the details in which were first published by Mrs. Marcet, in her Conversations on Vegetable Physiology; but these having been obtained by attending the distinguished author's lectures at Geneva, are necessarily imperfect, as well as abounding in unavoidable aural mistakes. It is to be regretted that the original work has not been translated into English, as it is by far the most complete, as well as the most correct in theory, with one or two exceptions, which an agriculturist could trust to in the chemistry as well as in the physiology of his science. So far as the chemistry of soils and manures is concerned, and more particularly the interesting subject of the rotation of crops, De Candolle is the highest authority we know; but with respect to fallowing, irrigation, and paring and burning, he is not so correct, either because M. Macaire's experiments, on which the true explanation of these processes depends, were not completed at the time he published his book, or that he did not advert to their important bearing on almost every part of the science of cultivation.

We hope that the preceding introductory remarks, and the brief sketch which follows them of the rise and progress of agricultural chemistry before Liebig, will afford the reader some preparation for considering the subject under such systematic and comprehensive views as may subsequently, if opportunity offers, be studied in more minute detail, so as to throw light upon the scientific principles on which every individual operation and process of the practical cultivator must incontrovertibly be founded.

As both the plants that constitute grass, corn, and other growing crops, and the horses, cattle, and other domestic animals kept on a farm, are living beings requiring nourishment in the form of food, or drink, the nutritive portions of which are digested and assimilated, while the non-nutritive portions are discharged as useless or noxious; it is obvious that the whole, if not the greater part of agricultural chemistry, must be

devoted to the kinds and qualities of the food or drink supplied, and the subsequent changes it undergoes after being acted upon by the living organs. It is farther to be considered that all living beings, whether plants or animals, have the two remarkable stages of infancy and full growth, in which the constitution differs so very much, as to require food or drink of materially different qualities and quantities. Taking these principles as a basis, then, we may arrange the leading subjects of agricultural chemistry under the following heads, so as to present its more prominent features at one view.

I. Agricultural chemistry of growing crops.
  1. Food of plants before and during germination or brairding.
    a. Preparation of seeds by steeping.
    b. Digestion, assimilation, and excrementitious discharge of this food.
    c. Noxious and injurious substances.
  2. Food of plants after germination.
    Soils and subsoils.
    Manures and Composts.
      Direct—rotted dung and dunghill drainings.
      Indirect—lime, bone dust, &c.
      Moisture—rain, dew, water of springs.
    a. Digestion, assimilation, and excrementitious discharge of this food.
        Light and Heat.
    b. Noxious and injurious substances.
      Iron, excrementitious discharges, &c.
    c. Remedies for these.
      Liming.
      Paring and burning.
      Fallowing.
      Irrigation.
      Rotation of crops.

II. Agricultural chemistry as applied to the gathering, storing, and preserving field produce.
  1. Chemical changes in the process of ripening seed.
  2. Chemical changes incident upon drying, and upon stacking corn and hay.
  3. Chemical changes incident to stored up potatoes, turnips, mangold würzel, and carrots.
  4. Chemical preparations of flax and hemp.
    a. Water steeping.
    b. Dewing.
    c. Earth layering.

III. Agricultural chemistry as applied to domestic animals.
  1. Food of domestic animals in infancy.
    a. Digestion, assimilation, and excrementitious discharges of such food.
    b. Noxious and injurious substances.

c. Remedies.

2. Food of full-grown domestic animals.

Grain.

Starch and its basis dextrine.

Roots.

Green Food.

a. Digestion, assimilation, and excrementitious discharges of such food.

Digestion in the horse and ass.

Digestion in cows, and other ruminant animals.

Digestion in the pig.

Digestion in dogs.

Digestion in fowls.

b. Noxious and injurious substances.

c. Remedies.

IV. Agricultural chemistry of dairy processes.

1. Churning of butter.

a. Salting of butter.

2. Cheese making.

a. Preparation of rennet.

b. Salting, colouring, &c.

It may be seen from this tabular view, that the topics which fall to be considered under agricultural chemistry are some of the most important in the whole science, and are so far from being useless, unnecessary, or incomprehensible, as we have seen them represented, that it is impossible for a farmer to go on for one day without frequent recourse to them. He must, of course, either practise his agricultural chemistry at random, or he must study the subject so as to acquire a thorough knowledge of the principles which regulate the several processes or operations. Taking this view of the subject, it cannot, we should think, ever become a question of rational dispute, whether a farmer ought or ought not to understand what he is doing, for this is in plain terms the true state of the value of agricultural chemistry.

It may not be unimportant nor unprofitable to introduce here a few illustrations of some of the subjects in the preceding table, not with the intention of going into them very minutely, for which we have neither room nor leisure, but to exemplify, in some measure, the method of study, and to afford some more proofs of its high importance as inducements to enter into the investigation.

The first subject in the table is of considerable moment, in as much as it involves the processes of preparing the seed, as well as of the circumstances to be attended to in sowing. From the practices but too commonly pursued in the preparation of agricultural seeds, wheat for example, we might justly conclude farmers to forget that the grain is alive and may be killed by improper treatment as certainly as a full grown plant. Were

the eggs, for example, which are about to be set under a hen for the purpose of hatching to be first plunged into brine, urine, solutions of arsenic, or any similar liquid, as is so commonly done with agricultural seeds, under the erroneous belief that the steeping would prevent disorders in the chicks to be hatched, free them from vermin, and the like, the absurdity would be so obvious, that it is not likely it would ever be followed. Yet, in nearly similar circumstances, do farmers almost universally steep their seed wheat in liquids which must to a certainty prove injurious, while any benefit resulting from the practice is at best extremely doubtful. It may be well to examine some of the directions given for steeping seed corn in detail, with the alleged results.

In the Bath Society's papers, we find Mr. Chappel recommending barley to be steeped for twenty-four hours in the black liquor which oozes from manure heaps, and on taking it out, to mix it with wood ashes, sifted with the grain to make it spread regularly.

According to Mr. Sommerville, a quantity of urine, in as stale a state as possible, is put into a vessel, in the same manner as for salt pickle, and into this the grain is put and well stirred. The contents are then poured through a sieve, and the process continued till the whole of the wheat intended to be sown is moistened. It is afterwards sprinkled with lime to dry it. Or, instead of mixing the whole grain with the urine, it is common to spread the wheat upon the barn floor, and sprinkle the urine upon it, either with a watering pot, or a kind of brush made of straw. When it is sufficiently moistened, lime is made use of as before, and the grain sown.

Now it requires but a small knowledge of the physiological principles of germination, and of the composition of dunghill drainings, or stale urine, to perceive that such steeping must be extremely injurious; for the sprouting grain, like a young animal, cannot feed on the rich and stimulant nutriment thus supplied, and will be as much injured as a new-born infant would be if it were gorged with turtle soup and port wine. We would anticipate, therefore, an injurious result from this consideration alone, independently of experiment.

We find, indeed, that the experience of practical men is in accordance with our anticipations. Mr. John Shirreff, for example, observes, that if wheat has been pickled with stale chamber-ley, dried with quick-lime, and put close together to lie for a day, not a grain will vegetate. It ought, he says, to be spread abroad, as thin as possible, to dry and get air; and Sir John Sinclair tells us that where urine is used, there is an absolute necessity of using the seed immediately. In other words, the noxious steep must be got rid of as soon as possible by evaporation or dilution with the moisture of the soil. This will

appear still more evidently from the observations of Mr. Sommerville, the writer already quoted.

"No article," he informs us, "at present employed, requires so much circumspection as the urine pickle, and there is none where the risk or loss attending its use has a chance of being so great. When urine is sufficiently stale to produce the intended effect of destroying animalcules, it abounds with the pungent and acrid ammoniacal vapour mentioned above as exhaling from horse-dung, which in this state is well known to be noxious both to seeds and plants, but when combined with lime its causticity is very much increased. This combined or rather mixed substance, indeed, though it is an excellent manure, when judiciously applied to the soil for some time before the sowing of the seed, is completely destructive to both the seeds and growing plants with which it is brought into contact. When seed wheat, therefore, has been completely moistened with urine, and is afterwards mixed with quick-lime, the crust with which it is surrounded will be of the most caustic nature, and nothing but sowing it immediately into a rather moist soil can possibly save it from destruction. Accordingly it has often happened, when wheat pickled with urine and dried with lime, has, by bad weather or any other accident, been prevented from being sown even for a single night, that nine-tenths of the seeds have perished. If, also, the soil happens to be of a warm nature, is very dry at the time of sowing, and if the weather continue warm and dry for any considerable time afterwards, a great deal of the seed will be destroyed by means of the urine and lime.

Surely then, when this process is not only troublesome and disagreeable, but so very dangerous, while it is quite certain it can never effect the intention of destroying noxious animalcules, supposing these to be present in the seed, which is at best doubtful,—we think few, who are made aware of the danger, will risk its occurrence.

Some farmers, instead of urine or dunghill drainings, use a brine made either with plain water with kitchen salt strong enough to float an egg, or sea-water rendered of similar strength. The pickle is made in an open vessel, containing from thirty to forty gallons, and a bushel or two of seed wheat is thrown in at a time and stirred well round with a stick or a broom. During the stirring the light grains rise to the surface and are skimmed off; the vessel is then lifted up and the contents poured into another of equal dimensions, upon whose mouth is placed a sieve which retains the grain and permits the pickle to pass into the vessel beneath. The same quantity of fresh wheat is again put into the pickle and treated like the first till the whole quantity of seed wheat has been pickled and washed. Progressively as it is taken out of the water, some new-slaked lime is sifted

on it, and the whole is at last mixed up with a wooden shovel, and frequently turned over, till it become sufficiently dry for sowing.

This method of steeping in brine is less objectionable than the urine only inasmuch as the salt is not so noxious, but the lime, which is added to dry it, is apt to prove injurious from its alkaline causticity. Mr. Sommerville, for several years, made trials of the brine pickle upon a given number of seeds sown at different periods of the season, and under different circumstances of warmth and moisture, and he uniformly found that when wheat pickled with salt and lime was sown, either upon ground containing a moderate share of moisture, or had a light shower soon after it was sown, scarcely one grain in ten perished; that is, the causticity of the lime was neutralized or rendered milder by moisture. On the other hand, when it was sown upon warm dry land, and no rain fell for perhaps two or three weeks afterwards, nearly one third of the seed never germinated at all. We should therefore be loth to try this salt and lime preparation of seed wheat.

Another pickle, prepared with arsenic, was much vaunted by the late Arthur Young, who directed half a hogshead of strong ley of wood-ashes or impure potass to be put into a boiler, with seven pounds of common salt and one pound of arsenic boiled well, and kept in the boiler, when cold, for use. This is confidently asserted to prevent smut, yet under certain circumstances it may be highly injurious to the crop; for though the grain steeped in the arsenic pickle may be kept good, it is said, for any length of time, in a moist state, (a very doubtful assertion,) it is quite otherwise when well dried and exposed to a certain degree of heat. Mr. Sommerville, indeed, informs us, as the result of many trials, that if wheat thus prepared is sown early in autumn upon dry warm land, and no rain falls for a considerable time afterwards, a circumstance not uncommon at that season, a great proportion of the grain will either be entirely destroyed, or materially injured. Arsenic, indeed, has been proved, by more than one experimenter, to be as poisonous to plants as it is to animals.

It will be quite superfluous to advert here to the chemical effects of other steeps upon seed corn, such as blue vitriol or sulphate of copper, recommended by Mr. Ruck, of Down Amptney, Gloucestershire. Enough has been said to shew the great hazard run of destroying the corn by their use, and it is not the proper place to prove that they cannot effect what is intended, since this would lead us away from our immediate subject.

We have already seen, that Mr. Brown, of Markle, while denouncing inquiries into the food of plants as unprofitable and incomprehensible, admits, at the same time, that rich soil and rich manure are necessary, in order to produce good crops.

Now the question is, what is rich soil and rich manure, and what is it in these that nourishes the growing crops better than barren sand or clay? That substance, whatever it is, must be the best food with which plants can be supplied. Sir Humphrey Davy, as we mentioned above, proved, by direct experiment, that this food could not be in a solid state, even in the minutest particles; and it has been ascertained by Hales, De Candolle, and all the physiological experimenters, that no fluid thicker than water is absorbed. It must follow, therefore, that the rich portions of the soil and of manure are diluted with water before they enter into plants.

Duhamel was greatly at a loss in attempting to ascertain these points. "The advantages," he says, "accruing from dung and rotten vegetables are too well known to be called in question, but it is not known whether they operate by detaining the moisture that is absolutely necessary to vegetation, or by loosening the particles of soil that are too compact, that the roots may have power to extend, or by exciting in the bosom of the earth a sort of fermentation, in consequence of the fat and oily matters they contain, in aid of the sort of digestion which tends to prepare the nutritive juice of plants, or, finally, whether some parts of dungs, either oil or volatile salts, do not enter as food into the substance of plants."[a]

The older agricultural chemists give very vague and unsatisfactory accounts of what they supposed to constitute the richness of soil and of manure. "The reasoners on agriculture," says Dr. F. Home, "have failed, because they asserted that plants were fed either by air, water, earth, or salt. I join, in some measure, with all these, and assert, that plants are nourished by these bodies, united with two others, oil and fire, in a fixed state. These six principles, joined together, in my opinion, constitute the vegetable nourishment. This easily appears, when we consider, first, that several kinds of nourishment, such as leather, hair, horn-shavings, rags, and all vegetables, and vegetable juices, in an entire state, prove proper food for vegetables. Secondly, that all vegetables and vegetable juices, afford those very principles, and no other, by all the chemical experiments which have yet been made on them, with or without fire." This, however, is not far from the truth, if we take "earth" to mean alkaline substances, "fire," to mean hydrogen and carbon, and "oil," to mean humin.

"Vegetables," says the Earl of Dundonald, "are nourished, supported, and formed, by air, water, earth, heat, light, and certain saline substances; and, in a particular manner, by their own exuviæ or remains, when reduced to a state fit to answer that purpose." That his lordship had a view of the nutritive principles of manure, surprisingly correct for the state of agri-

[a] Elemens d'Agriculture.

cultural chemistry at that time, appears, from what he states respecting the changes that take place in the dung of a farm-yard.

"When animal dung and vegetable matters," he says, "are mixed together, such as horse-dung, urine, straw, and hay, a degree of heat is generated and disengaged by the absorption of vital air, or oxygen and water is decomposed. As the process of putrefaction advances, ammonia, or volatile alkali is formed, and, in its tendency to escape from the heat, combines with such parts of the vegetables and matters of the dung, as had advanced to the oxygenated state, forming saponaceous saline matter. The formation of this saponaceous matter in the greatest possible quantity, will be promoted by mixing and covering the dung with a due proportion of earth; hence the dung of hot-beds is that which is most completely rotted, and most assimilated to the saline saponaceous state above described; and in this state is more capable of promoting vegetation than dung that had not arrived to an equally advanced state of putrefaction." "The preference, in most cases, is undoubtedly to be given to such dung as has most completely undergone the putrefactive process."

Mr. Kirwan, however, is more explicit and correct when he says, "the only substances common to growing vegetables, and the soils in which they grow, are water, coal [carbon], different earths, and salts; these, therefore, are the true food of vegetables: to them we should also add fixed air [carbonic acid gas], though, by reason of its decomposition, it may not be distinctly found in them." "The agency of water in the process of vegetation, has not, till of late, been distinctly perceived. Dr. Hales has shown, that in the summer months, a sunflower, weighing three pounds avoirdupois, and regularly watered every day, passed through it, or perspired, twenty-two ounces each day; that is, half its weight." "Water is decomposed by the assistance of light within the vegetable; its inflammable part [hydrogen] is employed in the formation of oils, resins, gums, &c. Its pure air [oxygen] is partly applied to the production of vegetable acids, and partly expelled as excrement."

What follows is still more to our purpose: "to M. Hazenfratz," continues Kirwan, "we owe the discovery that coal [carbon] is an essential ingredient in the food of all vegetables." "Coal not only forms the residuum of all vegetable substances that have undergone a slow and smothered combustion, but also of all putrid vegetable and animal bodies. Hence it is found in vegetable and animal manures that have undergone putrefaction, and is the true basis of their ameliorating powers. If the water that passes through a putrefying dunghill be examined, it will be found to be of a brown colour, and if subjected to evaporation, the principal parts of the residuum will be found to consist of coal [carbon]. All soils steeped in water, communicate

the same colour to it in proportion to their fertility; and this water being evaporated leaves also a coal as Hazenfratz and Fourcroy attest." "Coal [carbon], however," he adds, "cannot produce its beneficial effects, but inasmuch as it is soluble in water. The means of rendering it soluble are not yet well ascertained; nevertheless, it is even now used as a manure with good effect."

It is fortunate for the student of agricultural chemistry that the means or rather the modes thus unknown in Kirwan's time are now tolerably well ascertained; but before mentioning these it may not be irrelevant to advert to what may not unjustly be termed the retrograding, where it ought least to have been expected, of Sir H. Davy; for so far from being before, the following is, in vagueness, certainly behind the science of Dr. Home already quoted. Sir Humphrey says, "mucilaginous, gelatinous, saccharine, oily, and extractive fluids and solutions of carbonic acid in water, are substances that in their unchanged states contain almost all the principles necessary for the life of plants; but there are few cases in which they can be applied as manures in their pure forms, and vegetable manures in general contain a great excess of fibrous and insoluble matter, which must undergo chemical changes before they become the food of plants." Mr. Hayward not unjustly remarks of this statement, that "it is worse than useless, being calculated to mislead, bewilder and confuse, and to shake the confidence of mere practical husbandmen in the general doctrines of chemistry."

(To be continued.)

TERRESTRIAL ELECTRICITY.

By John Joseph Lake.

THE EARTHQUAKES OF 1755.

The earthquakes commonly known as "the Great Earthquake of Lisbon," having been adduced as a proof that electricity has nothing to do with the production of such phenomena, it is particularly necessary they should be considered, especially as they will be found to support the opposite theory.

During 1750, and the four following years, there appears to have been a disturbance of the usual passage of the electric fluid which occasionally discharged itself, producing the tremors of the earth that were felt during that period. The state of many strata was also altered, during the same time, by a great drought that prevailed, which reduced the conducting power in a greater or less degree of those strata that require

moisture to render them suitable for the purpose. The fatal year 1755, however, was very wet, and as some strata are more porous, and absorb moisture quicker than others, one would have its conducting power renewed long before another. This, if fluid had gathered, would accelerate, and even produce shocks of earthquake, for the barrier opposed to the progress of it would be weakened, and an alternation of good and bad conducting strata be produced.

On the 31st of October, the day previous to the fatal event, the presence of electric fluid was denoted at Lisbon by a remarkable gloominess that prevailed in the atmosphere, which obscured the sun; and at Colares, at 4 P.M., a fog came over the sea, and the latter rose with a prodigious roaring[a].

The 1st of November began at Lisbon with a thick fog, which was soon dissipated by the sun. The weather was remarkably warm, an universal stillness prevailed, not a breath of wind stirred, nor was there the least agitation of the sea. In the midst of this quietness the catastrophe began.

At Colares, twenty miles from Lisbon, the same morning broke with a serene sky, but *about*[b] 9 o'clock the sun grew dim, and a noise like that of chariots was heard, which increased until it equalled the roar of cannon, and immediately a shock of earthquake was felt.

The probability of the wet weather of 1755 producing an alternation of good and bad conducting media in the earth, has been spoken of; but whether this produced them or not, the effect of such a series was distinct, and denoted by a noise as of chariots running[c].

The shocks at Lisbon seem to have been felt rather later than at Colares, being at 35 minutes past 9, A.M. The first shock raised up the earth, as would be the case on the occasion of a subterranean electric discharge. This is proved by the bar being laid dry from shore to shore, the bed of the Tagus rising in many places above its surface, and the retiring of the sea. When the earth fell in again the sea returned, rolling like a mountain, and, by the impetus it had obtained, went inland, and rose to the height of 50 feet near Belem Castle.

The shock also came on with a rumbling subterranean noise, which, with the attendant circumstances, explains the effects observed at Colares. The shocks were at first short and in quick succession, as through a series of insulated conductors, producing the noise heard at Colares as of chariots. This noise changed, and increased until it equalled the roar of can-

[a] The sea was affected during the earthquakes in Calabria in 1638.—Polytech. Review, May, 1844, p. 263.

[b] Much difficulty occurs from the loose manner in which the time and many circumstances connected with earthquakes are recorded, as will be observed in the progress of these remarks.

[c] Polytechnic Review, May, 1844, p. 263.

non, when the conducting media were further apart, for then the discharges were more violent.

At Funchal, in the island of Madeira, the shaking was felt at the same time as at Lisbon, and the phenomena indicated an electric discharge. It lasted only one minute, and was preceded by rumbling noises in the air, as of empty carriages. The noise accompanied the shock during the whole of its continuance, and lasted some seconds after the motion of the earth ceased. An observer described it as "dying away like a peal of thunder." There is not information enough recorded to explain how the discharges produced the noises in the air, but it is sufficient that it was of electric, and not of volcanic origin.

The shocks were felt simultaneously in many places, as Lisbon, Madeira, and Great Britain; and it appears highly probable that a wave of earthquake moved from these points, similar to the tide wave of the ocean and atmosphere. But the accounts on record only enable us to trace it from the neighbourhood of Lisbon. It appeared at Ayamonte in the bay of Cadiz, "a *little before* 10 A.M.; at Arzetta in Fez and Tangier, "*about* 10 A.M;" at Gibraltar and Madrid simultaneously, but "not *till after* 10." It can also be traced at sea as well as by land. At Ayamonte the sea came in in great waves "in *little more* than half an hour after the shock," though the day was serene, and not a breath of wind stirring. At Cadiz, at 10 minutes after 11 A.M., a wave came in from the sea at least 60 feet higher than usual, and at half-past 11 another. At three quarters past 11 A.M., a great wave came in at Funchal, the draught of which, on its approach, drew the water several feet from the shore, and the sea retired and returned four or five times, both here and at other places in Madeira.

If space permitted, many other curious phenomena might be brought forward and explained; none, however, having any resemblance to volcanic action, it does not appear necessary to allude to them*. But the following must not be passed over. Cap-

* The following are remarkable, and were produced by the vertical movement of the ground, as may be proved by taking a basin partly filled with water, and suddenly raising or sinking it: the water will sink or rise in the middle or at the sides, and continue to do so until it gradually subsides. Near Durham, "about half an hour after 10," a rushing noise was heard to issue from a pond, and its waters were seen to rise and descend alternately during five or six minutes, making four or five such vibrations in a minute. At Eaton Bridge, Kent, the water of a pond opened in the middle, so that a post in it was seen almost to the bottom, and the water dashed over a bank two feet high, and perpendicular to the pond; this was repeated several times with great noise. At Loch Lomond, in Scotland, "about half an hour after 9 A. M.," the water, without any apparent cause, rose against its bank with great rapidity, then subsided far below the usual level; it rose again, and so forth. The greatest perpendicular height of this swell was two feet four inches. A large stone, lying at some distance from the shore, but in such shallow water that it could easily be seen, was forced by the sudden jerk out of its place in the lake upon dry land, leaving a deep furrow

tain Clark, from Deina, lat. 36° 24′ N., between 9 and 10 A.M., had his ship shaken and strained as if she had struck on a rock, so that the seams of the deck opened and the compass was overturned in the binnacle. The master of a vessel bound to the American islands, being in lat. 25° N., long. 40° W., and writing in his cabin, heard a violent noise, (the electric discharge,) and while asking the cause of it, the ship was put in a strange agitation as if she had been jerked up and suspended by a rope at the mast head, (the effect of the upheaving of the bottom of the sea communicated to the water.) On looking out of the cabin window he saw what seemed to be land about a mile distant, but coming upon deck, the land was no more to be seen; he, however, perceived a violent current across the ship's way to the leeward, (which was the return of the water that had been displaced by the elevation of the bottom of the ocean.) In about a minute this current returned with great impetuosity, (through a second elevation of the bottom,) and at a league's distance he saw three craggy pointed rocks throwing up water of various colours *resembling* fire. This phenomenon ended in about two minutes in a black cloud, which ascended very heavily. After it had risen above the horizon no rocks were to be seen. Between 9 and 10 in the morning another ship, 40 leagues west of St. Vincent, was so strongly agitated that the anchors, which were lashed, bounced up and the men were thrown a foot and a half perpendicular from the deck. This also was from the upward movement of the bottom of the ocean communicated to the water. Immediately after this the ship sunk in the water as low as the main chains. The lead shewed a great depth of water and the line was tinged with a yellow colour, and smelt of sulphur. The shock lasted about 10 minutes, but smaller ones were felt during about 24 hours after the first.

Though the shocks were felt in Great Britain, Sweden, Norway, Germany, Holland, France, the Peninsula, Italy, Switzerland, Antigua, Barbadoes, and other places; these, and some smoke that ascended from the hill Fojo, near Colares, are the only appearances at all volcanic. Of the smoke, very thick but not very black, at the latter place we can make nothing, for on visiting the spot whence it proceeded no sign of fire could be perceived near it. But the phenomena in the neighbourhood of the West Indies merit a short consideration.

in the ground all along the way it had moved. At Barlborough, in Derbyshire, the impulse was diagonal, and from the south. "Between 11 and 12 A. M.," a surprising and frightful noise was heard near a large body of water called Pibley Dam. A large swell of water came in current from the south, and rose two feet on the north side of the lake; it then subsided and returned again, and so on, gradually decreasing in its motion, until it entirely ceased. A similar noise, with agitation and overflowing of the waters of a canal, was observed "about half an hour after 10" A. M. in Busbridge, and also in a pond at Cobham, Surrey.

The fire seen in lat. 25° N. does not seem to have been flame; for it is described as "*water of various colours resembling fire*,"[a] and its duration about two minutes. This had every appearance of being electrical for the following reasons:—The fire, or appearance of it, seemed to exist in the water itself, and most probably arose from the sulphur and other colouring matter, and weeds[b] raised with the rocks from the bottom; or it might even be occasioned by electric excitation produced by the passage of the rocks through the water; for as the motion of water against a body produces it, so the rapid motion of a body through water has, there is every reason to suppose, the same effect[c]. Certain it is that neither flame nor fire can exist in water. It is also to be observed that no volcanic or burnt matter of any kind, as pumice stone and ashes, were found; no steam either appears to have been generated, which, if fire had been present, would have been the case. Taking, therefore, all the circumstances into consideration, the only explanation that can be given of the smoke is, that it originated from the combustion of sulphur and other inflammable materials by the electric discharge, the power and magnitude of which are shewn by the rocks forced to the surface of the Atlantic Ocean; for if it had been produced by the breaking forth of subterranean fire, lava, pumice stone or other calcined matter would have been found on the hill Fojo or floating at sea. Nothing of the kind however appeared, though the shocks were felt from Norway to Madeira, and from the West Indies to Italy.

ON THE DIRECTION OF ELECTRIC CURRENTS, AND THE CAUSE OF THE MAGNETIC NEEDLE POINTING TO THE NORTH.

We have seen that the electric fluid is in greater intensity in mountains and elevated regions[d], and that there is a constant current of it flowing towards the tropics[e]. But on account of

[a] Rees's Cyclopædia, art. *Earthquake.*

[b] The Red Sea owes its name to its red appearance, which arises from weeds of that colour growing in it.

[c] A remarkable instance of the appearance of fire was observed by Don Juan de Castro in the Red Sea. It is thus alluded to by Lord Valentia in his Travels, vol. ii. p. 246:—"We were astonished, when in twenty-two fathom, with the white appearance of breakers; when the captain immediately let go the anchor. The pilots declared that it was only fish, and so it proved; for soon afterwards they approached and passed under the vessel. It is singular that the same circumstance should have been observed by Don Juan de Castro, and should have had the same effect of inducing him to let go his anchor. He does not account for it because it happened in the night, but he mentions that it cast flames like fire." His Lordship considered it to result from fish spawn, but if so it would not have advanced and passed under the ship. Since the discovery of electric excitation by the motion of water, I am inclined to consider that it resulted from the passage of fish through the sea. And also to refer the sparkling of the ocean to the same principle.

[d] Polytechnic Review, May, 1844, p. 263.

[e] Ibid.

the repulsion from the opposite side of the earth, a current of fluid will not descend into valleys so long as it can find a conducting medium in mountains or high lands [a]. The electric fluid, therefore, flows in preference along the latter, and the general direction of its currents must be that of the mountainous and elevated parts of our planet. These are arranged in the following table:—

Name of Country, District, &c.	General direction of Mountains and High Lands.	Name of Country, District, &c.	General direction of Mountains and High Lands.
Europe	N.E. to S.W. (A.)	Italy	S.E. to N.W. (B.)
England		Austria	
Scotland		Hungary	
Norway		Greece	
Spain		America, South	
Switzerland		America, North, (the Western ranges)	
America, North, (the Eastern ranges)		Russia (Europe)	N. to S. (C.)
Ireland	N.N.E. to S.S.W. (A.)	Denmark	
Holland and Belgium		France	Various. (D.)
Sweden	N.E. to S. (A.)	Germany	
		Asia	
		Africa	

By this Table it appears that the high lands of the earth form two lines, of which the one is at right angles to the other; the main direction of the one (A) being from north-east to south-west; that of the other (B) from south-east to north-west. It is also to be observed that A nearly doubles B. To simplify the following explanations, the remaining cases will be passed over, as the influence of C must be comparatively small and that of D neutralized. Hence there are two general directions in which the electric currents flow; one on a line drawn from south-east to north-west (B), the other on a line from north-east to south-west (A). As A nearly doubles B, the electric currents along A must exercise a greater influence than those along B. Every electric current is accompanied by a magnetic action at right angles to it, and the north pole of a magnetised needle is always directed to the same side of an electric current. Even if entirely reversed, it will, when left to itself, return to its first position, so long as the current continues.

On this principle and in this manner, the electric currents of the earth affect the compass. For the currents that flow from north-east to south-west, would cause the needle to point north-west, but the other currents from north-west to south-east prevent this, and would force the needle to point north-east. According to a mechanical law, if these two forces were of equal strength, the diagonal to the directions in which they are ex-

[a] Polytechnic Review, May 1844, p. 263.

erted would be the direction of the magnetic needle, that is, due north. But when they are unequal, the line of direction will incline towards the side of the weakest force, that is, to west of north, for the electric currents from north-east to south-west are more powerful than those from north-west to south-east. This, then, is the cause of the direction of the needle to the northward on the eastern side of the American continents. The same principle, under different circumstances, produces a similar effect on the western side, which it is now intended to consider.

To the west of America a very large portion of the surface of the earth is water, constituting the North and South Pacific Oceans. Hence, there being no elevations, there is a deficiency of electric currents, and a very small proportion of fluid in that region[a]. It would, therefore, follow that the currents along the American mountains, all the others being remote, would act very powerfully on the needle and cause it to point toward the south-west when under induction from the northern continent, where the great electric current flows to the south[b] and towards the north-east when under induction from the southern continent, where the electric currents flow towards the north[c]. But the great North American current from north-west to south-east is neutralized to a very considerable extent by another current along the eastern ranges from north-east to south-west, and this neutralization is completed by the influence of the great currents of the eastern hemisphere. Hence, the South American and other unneutralized currents parallel thereto, regulate the direction of the magnetic needle to the west of America. But they do not altogether govern it, for the eastern currents from north-east to south-west cause it to point much more to the north than would be the case if they were absent.

Hence, the direction of the magnetic needle is not regulated by any particular current of electric fluid, but is the result, in every part of the world, of the general action of all the electric currents of the earth upon it, and, hence, its direction is always to one quarter[d].

[a] Polytechnic Review, May, 1844, p. 263. [b] Ibid. [c] Ibid.

[d] "All the variations at night were towards the east[1], whether the Aurora was actually visible or not; and hence may we not conclude, taking it for granted that it is an electrical phenomenon, that it usually moves from about the north towards the south, that it must be of the nature of positive electricity? And by a parity of reasoning, may we not assume the existence of an opposite state of electrical action by day[2], in order to account for the westerly variation which is most considerable in summer in these latitudes, when the Aurora prevails about the South Pole? This idea seems to be strengthened by a fact I have noticed, that the magnetic intensity is usually less considerable in summer before the middle of the day than it is after-

[1] I have since observed a slight variation in the needle at night, but this seems to be of rare occurrence.

[2] Polytechnic Review, May, 1844, p. 263.

The difference between the horizontal, and dipping or vertical needle, is entirely in the mode of suspension; for if the latter were suspended to act horizontally, it would show the same effects as the horizontal needle, and so the horizontal needle, if suspended to act vertically, would show the same results as the other.

It was observed by the Rosses, on their second voyage to the Arctic regions, that in lat. 70° 5′ 17″ N., long. 96° 46′ 45″ W., the spot named by them "The North Magnetic Pole," the horizontal needle ceased to traverse, but remained in the position in which it was placed, even when suspended by a single fibre of floss silk or flax [a]. This resulted from that spot being the centre balance or vortex of the electric currents of the earth, or that part of the surface nearest to it, and the magnetic needle being sufficiently near to this centre or vortex to have its action neutralized by the balancing influence of the several currents when suspended horizontally. This neutralizing effect upon the horizontal needle extends a great distance from this spot, for off Cape York, in lat. 73° 40′, when the motion of their vessel became considerable, the compasses (Pope's, Gilbert's, and Alexander's) ceased to traverse. It is even felt on the St. Lawrence; so much so, that the sluggishness and uncertain variation of the compass assist greatly to render the navigation of that river difficult.

At "the North Magnetic Pole," where the action of the horizontal needle ceased, the dipping or vertical needle indicated 89° 59′, or within 1′ of the vertical, and it is highly probable that the instrument did not show 90° for want of some nicety in construction which had not previously been required. This intense action of the dipping needle shows that the spot was over the centre or vortex of the electric currents, and that they acted upon it from every side with the same intensity.

As the direction of the magnetic needle arises from the action of electric currents, and as the latter are affected by the sun, it follows, that the sun influences the action of the former through them. Hence the fluctuations noticed by Mr. Fox.

Besides the daily, there is another irregular change constantly going on in the direction of the needle, from geological alterations changing the direction of electric currents, and these are greatly promoted by earthquake and similar convulsions. The variation was formerly east of north, in the eastern hemisphere, but it is now to the west. Thus, in 1576 the variation, at London, was 11° 5′ E., and, in 1612, 6° 10′ E., making a change of 4° 55′ in thirty-six years. During the same period, in 1586,

wards; so that the minimum intensity commonly occurs some hours before the maximum temperature."—On the Variable Intensity of Terrestrial Magnetism, and the Influence of the Aurora Borealis upon it. By Robert Were Fox. Philosophical Transactions, 1831, p. 199.

[a] "On the Position of the North Magnetic Pole," by Commander James Clark Ross.—Philosophical Transactions, 1834.

a mountain near Panacura, in Java, was shattered in pieces by a violent eruption of glowing sulphur, and in 1600 there was an earthquake at Arquepa, in Peru, when a volcano broke forth, accompanied with an eruption of sand, ashes, &c., which continued during twenty days. The sand and ashes covered the fields ninety miles one way, and one hundred and twenty another, varying in depth from a quarter to two yards; shewing the violence and extent of the internal commotion. There are no records of any similar convulsions during the next ten years, and in the course of the same period the variation changed only 10′, being 6° 10′ E. in 1612, and 6° E. in 1622. But the next twelve years brought about a change of 1° 55′, and on the 16th of June, 1628, there was an earthquake in the island of St. Michael's, one of the Azores, near which the sea opened, and in one place, where it had been 160 fathoms deep, an island was thrown up, which in fifteen days was three leagues long, one and a half broad, and 360 feet above the water. In 1631, there was an eruption of Vesuvius, and in 1632, rocks were thrown three miles from it. In 1634, the variation was 4° 5′ E., and in 1657 the needle pointed due north, so that in twenty-three years there was a change of 4° 5′. During this period occurred the earthquakes of Calabria, in 1638, and in 1646 many of the Andes were quite swallowed up. So ever since, the change of the variation to any extent has always been accompanied by internal convulsions of the earth.

EARLY HISTORY OF MINING IN SPAIN.

By William Walton.

That in the Iberian peninsula the ancients had mining establishments, is proved by the records of both sacred and profane history, as well as by numerous vestiges left behind them. So high, indeed, was the opinion which they entertained of the mineral riches distinguishing that division of Europe, that some of the early poets represented it as the gloomy abode of Pluto. The Rhodians appear to have been the first migratory tribe who established themselves on the coast of Catalonia, where they built *Rhoda*, now Rosas. Allured by reports of the quantities of silver which they sent home from their new establishment, we are told that the Phœnicians dispatched an exploratory fleet from Tyre, under the orders of Pygmalion, who, descending the Mediterranean, effected a lodgment near the spot where Malaga now stands, and afterwards passing the straits, established himself at or near Cadiz. Their thirst for conquest increasing with its gratification, the Phœnicians attempted the subjugation of the country nearest to their strongholds, when the natives, enraged at their rapacity, and wearied out by their oppression,

rose and expelled them. Having repaired their losses, they again appeared upon the Iberian coast, in a more formidable attitude, and under the pretext of rebuilding the temple of Hercules once more obtained a footing at Cadiz; but at length the inhabitants, roused by their injustice and extortions, took up arms, and they were a second time in danger of being driven away. In this emergency they applied for aid to the Carthaginians, originally a colony of Tyre, who gladly availed themselves of this opportunity to visit Spain—the land of promise. The Turdetani, a spirited race inhabiting the southern division, prepared to oppose them, when the Carthaginians, not liking to risk their prospects on the issue of a contest, had recourse to artifice, and persuaded the natives to allow them to retain possession of certain places on the coast. Once firmly established, they quarrelled with their old allies, the Phœnicians, who in the end were ejected.

This forms a decided epoch in the history of Spain, (B. C. 491,) but it is not till after the appointment of Hamilcar to the command of the Carthaginian settlements, that any very authentic details of what passed there can be gathered. Hannibal, his son, then a youth only nine years of age, accompanied his father to Spain, who, on his arrival, received friendly overtures from the Turdetani, whose alliance he ever afterwards courted. On the death of Hamilcar, Asdrubal, his son-in-law, succeeded to the government, and built Carthago Nova, now Carthagena. Hannibal, who in the interval had returned home, was sent back to Spain by the senate, where his arrival excited a tumultuous joy among the soldiery, and on the demise of Asdrubal, he was enthusiastically proclaimed governor, although only twenty-six years of age. The Turdetani remained faithful to him, while the Saguntines and other native tribes joined the Romans. The contest which ensued between these rival powers for the dominion of Spain, is well known. Through the prudence and energies of the two Scipios, during Hannibal's absence, the cause of the Carthaginians began to decline, and after the fall of Asdrubal's new city, sank to rise no more (B. C. 208). If, however, the dates handed down to us are correct, they must have held possession of portions of the Mediterranean coast of Spain for more than two hundred and eighty years, during which period they continued in close alliance with the Turdetani, expert miners, and it is but reasonable to conclude that, as conquerors or traders, they joined the natives in those underground operations for which the country offered so many facilities.

Posidonius, Aristotle, Diodorus Siculus, Justinus and other writers have left us confirmatory accounts of the mineral wealth existing in the Iberian Peninsula, of which that of the first is the most minute and flattering. The testimonies of Strabo and Pliny may however suffice. Speaking of Turdetania, the former

remarks, "that there is a chain of mountains (Sierra Morena), which runs parallel with the Bœtis (Guadalquivir), and contains a number of mines. Silver, more especially, is found in the vicinity of Slipa (Alcala del Rio) and Sisapon (Almaden). What renders Turdetania more deserving of admiration," he proceeds, is, "that besides a variety of other productions, it still has excellent mines—in fact, all Iberia is full of them, nor is there any other part of the world where gold, silver, copper, and iron are to be found in such large quantities, or so good in quality."[a] Strabo affirms that the Turdetani were the best informed people in Iberia, active in trade, and skilful miners. Quoting Posidonius, he says, "that they derived a large profit from their mines, the copper ore yielding as much as one fourth of pure metal, and that the silver mines in three days furnished to individuals a quantity of metal equivalent to an Eubean talent."[b] As an additional proof of the abundance of silver found among the Turdetani, he states, that when the Carthaginians first visited them, their wine jugs and goblets were made of that metal.

Pliny confined the 33rd Book of his extensive compilation on Natural History, so deservedly considered as the Encyclopædia of the ancients, to a dissertation on mines and metals, in which he particularly mentions those of Spain, where he once held the appointment of governor, and consequently enjoyed great facilities of observation. He describes that country as being a rich repository of gold, found not only in alluvial beds and rivers, but also in veins. "Silver," he remarks, "occurs in most countries, but the most beautiful is in Spain."[c] Further on he says, "that it was wonderful to see the mines of this metal, the working of which commenced so long ago under Hannibal, still continue yielding, and even retaining the names of those Carthaginians who discovered them, of which one is called Bobelo, the designation which," he adds, "it still bears, and once so prolific that it furnished Hannibal with 300 lbs. per day, although the excavations had been driven to a mile and a half in extent."[d]

Pliny's description of mining for gold in Spain, which he likens to the work of giants, is curious and minute. He tells

[a] Strabo, Book III., of his Geography. This division of the work is devoted to a description of Spain, and so accurate has it always been considered there, that a separate translation of it was published at Madrid, with a map by Lopez.

[b] Talents differed so much according to the varied standard of the *minæ* and *drachma*, that it is difficult to fix the exact weight here meant. If it was the Egyptian talent, it corresponded to 80 lbs. troy weight, but if the Insular one, to 180.

[c] Argentum reperitur omnibus fere provinciis, sed in Hispania pulcherrimum. Ibid. chap. 4.

[d] The Roman libra, or pound, was only 10 oz. 18 dwts. 13 grains, Troy weight.

us that the workmen cut enormous passages under ground, digging by the light of lamps, and frequently not seeing a glimpse of the sun for a month together. Sometimes these galleries gave way, overwhelming the victims toiling within them, although usually they were timbered. The rocks were softened with vinegar, and then burnt; but the smoke occasioned by this process in the close cavities was so great, that, as far as possible, it was dispensed with. Recourse was therefore had to the pickaxe and wedge; but besides ordinary implements, the labourers used an engine, with a mallet weighing one hundred and fifty pounds, wielded, no doubt, by the aid of a lever, possibly on the principle of the battering-ram. The entrance to the mine was an inclined plane, with steps, and to clear away the rubbish it was thrown into baskets, and passed on, from hand to hand, by gangs. As soon as the excavations were completed, and every thing ready, at a given signal the workmen were withdrawn, when the props and timbers being dragged away, the superincumbent earth fell in with a tremendous crash. The side of a hill was thus frequently dislodged.

An equally difficult part of the undertaking, however, still remained to be performed, for, even after an achievement of such great magnitude, it was yet uncertain whether the treasure sought for could be discovered. By collecting the mountain springs together, it therefore became necessary to bring on a stream of water to the top, directing it in such a manner that in its fall the broken ground might be washed, and the heavier particles carried down to a pond below, provided with sluices, an operation often requiring the most difficult levels. Tedious, and in many respects inefficient, as this part of the process must have been, the principle applied was nevertheless in accordance with the certain and unchangeable law of gravity, and consequently could not be erroneous. The waste of labour must however have been immense. The sluices were afterwards opened, and the water drained off, when the earth deposited in the pond was carefully washed. After describing the several stages of this method of mining for gold, which proves that the ancients accomplished their work by means of numbers and main force, rather than art, Pliny goes on to say "that in this manner Spain had grown mightily in wealth, and was full of treasure;" adding, that "Asturias, Galicia, and Lusitania, annually yielded 20,000 lbs. weight of gold, obtained in the manner above described.

Pliny's account of the Almaden quicksilver mines is circumstantial, which, he says, were extremely valuable to the Romans, the produce being rated at 10,000 lbs. weight per annum. The ore was not refined on the spot, but conveyed to Rome in packages carefully sealed up, where, in its native state, or as vermilion, it was used by painters, or for the ladies' toilette [a],

[a] It is a curious fact that when the Spaniards first visited Peru, they

and the remainder prepared for medicinal and other purposes. The same author remarks, that "the earth, which produces silver, is at one time reddish (ferruginous), and at another grey, or ash-coloured (galena), and that no fusion could be obtained without the mixture of leaden ore, usually met with in silver lodes, the best quality of which came from Spain." The process of dressing and smelting ores, adopted by the ancients, when compared with the modern one, must have been very defective. Strabo tells us, that in Spain, after crushing the mineral, and sifting it in sacks, moved in water, the residuum was again pounded and washed, as often as five times consecutively, when the deposit was dried and submitted to the action of fire, by which means the lead became separated, and passed off, while the silver remained in its pure metallic state.

Modern researches have clearly proved that one of the most remarkable, and at the same time extensive theatres of mining operations, carried on by the ancients in Spain, was the Sierra, or mountain range, rising a little above the City of Carthagena, and extending from east to west as far as Cape Palos, a distance of about twenty-one miles, on a width of rather more than three, the highest point of which is 2000 feet above the level of the sea. The geological formation of this region is of the most striking character, owing to the disorderly state of the rocks, and the quantity of minerals, chiefly composed of oxidized iron, dispersed throughout, bearing, as it does, upon the surface evident marks of mighty dislocations. The upper divisions of the strata belong to the transition series, but no organic remains have been found among them. The materials scattered on the lower parts of the range, in some places are cemented together, but in others left loose and in fragments, towards the coast seen in the shape of boulders, or large rounded stones, which would denote an alluvial origin of a most powerful character. Some of these stones near the coast have been dug at a considerable depth. Perhaps no spot in Europe, of the same size, contains so great a variety in minerals, or so many objects of scientific interest, as this group of hills; nor is there one that was so extensively worked by the ancients. Polybius, as quoted by Strabo, affirms, that the silver mines near Carthagena were situated 20 stadii (2½ miles) from the city, and occupied a circuit of 400 stadii (50 miles), yielding to the Romans 25,000 drachms (234 lbs. weight) of metal per day. Strabo adds, that, in his time, these mines existed, but had passed from the State into the hands of individuals.

On this same locality there are, at the present moment, upwards of 100 new workings going on, and the discoveries of

found the Indian women using the vermilion, gathered in the quicksilver mine of Huancavelica, as rouge, which they smeared on their faces and necks, as the Roman ladies did that brought from Almaden.

vestiges left behind them by the ancients, in every part, not only in the form of enormous excavations, but also of mutilated statues, pillars, and inscriptions, chiefly Roman, are frequent, and of the most interesting kind. Several of the new companies availed themselves of old apertures, and have also incorporated old levels, of considerable extent, with their own works, after clearing away rubbish which for ages had accumulated in the interior. Mazarron, a small town situated at the foot of the San Cristoval Cliff, a quarter of a league from the sea, and five from the City of Carthagena, was built by the Carthaginians, probably in Hannibal's time, and from the number of old mines opened in the vicinity, ruins of smelting works, aqueducts, and other remains, indicating enterprises of a most gigantic kind, it would seem that here they had an extensive mining establishment. These works were resumed by the Romans, afterwards by the Moors, and continued by the Marquis de Velez till the year 1600, when they were closed, as it is supposed, in compliment to the new discoveries in America [a].

The diggings on this spot were chiefly for lead, silver, copper, iron, and alum. Cascales, an early writer, and much esteemed, speaks of the neighbouring caves of Porman and Don Juan, as containing amethysts and other valuable stones [b], and it certainly would appear that these stupendous cavities are not natural curiosities, but the works of man. If so, the excavations must have been made in search of minerals or precious stones. Recent researches have however shown, that in their sinkings, whether vertical or horizontal, the ancients avoided, as much as they could, the hard ground, which may be attributed to their defective implements, the use of gunpowder being unknown to them. The *tumuli*, or heaps of scoria, or slag, called by the Spaniards *escoriales*, and left scattered about in every direction, like so many artificial hills, furnish the strongest evidence of the great extent to which the ancients carried their mining operations in Spain, as well as of the imperfect manner in which their ores were reduced. In a report on the Sierra de Cartagena, made by D. Nicolas Toledano, civil engineer, and dated March 1, 1843, it is affirmed that the heaps of old slag on this locality alone could not be smelted in

[a] In consequence of an unusually heavy fall of rain, which, on the 6th of September, 1825, flooded the whole town of Mazarron, on the northern side of it, were left bare two parallel rows of twelve troughs, six feet long, four wide, and one deep; the bottoms of which were flagged, and the sides built up with strong masonry. In these it is supposed that the ore was washed, and to the east of them was also then discovered a large and deep reservoir, for the reception of the water drawn from a well situated near, the bore of which still remains perfect. These works are attributed to the fifteenth century, and show that the Spaniards had then a better system of washing ores than when the new mining era commenced.

[b] Discursos Historicos de Murcia, 1614.

twenty-five years, the quantity, as far as he could judge from a hasty view, contained in some of them, exceeding 400,000 quintals. In other parts of the country similar *tumuli* may be seen. Near the Rio Tinto mines they are numerous, and of an enormous size, where they are rendered the more remarkable by their bare and barren aspect, scarcely a plant growing upon them, a nudity singularly contrasted with the verdant appearance of the neighbouring grounds.

The metals procured in Spain during the early ages, unquestionably were more varied and valuable than those occurring in any other part of the then known globe, serving, as they did, to the natives for all the purposes of barter and enriching those conquerors who successively held dominion over them. From the extent of their settlements and the friendly relations which they respectively established, both the Carthaginians and Romans must have drawn a large portion of their precious metals from the Peninsula, more especially silver. Lamenting the luxury, in the use of gold and silver articles introduced into Rome, Pliny asserts that under the empire of Claudius, one of his slaves, Drusillanus, surnamed *Rotundus*, and formerly an intendant in Spain[a], possessed a silver dish weighing five hundred pounds, for the casting of which a furnace had been purposely constructed, and as it were, to complete the service, he had besides eight more, weighing together eight hundred and fifty pounds. "Great God!" exclaimed the philosophic author, after penning the above astounding fact, "how many beings like himself did this slave employ to serve up his dinner, and who were his guests?" From the same authority we learn, that when Claudius returned in triumph from Britain, the inhabitants of Spain (Citerior) presented to him golden crowns weighing altogether seven hundred pounds. Livy repeatedly mentions the quantities of precious metals which the ex-governors carried away with them from that country, although it must be borne in mind that they only served one year. Cato (he says) delivered up to the treasury at Rome 25,000 lbs. of silver in bars, and 120,000 in coin, besides 400 in gold; Helvius, governor of Andalusia, 37,000 lbs. in coined silver and 40,000 in bars; Minutius 80,000 lbs. in silver bars and 300,000 coined, while Fulvius adorned his triumphal entry with 124 golden crowns, 31 lbs. of the same metal, and 170,000 in coined silver. Pliny remarks, that the Romans invariably levied their tributes in silver, and that when they subdued Carthage the amount exacted from the inhabitants equalled 12,000 lbs. of that metal, stipulated to be paid annually and for fifty years,

[a] From several inscriptions and other testimonies, it is clearly proved that the Romans had a procurator or intendant of the Sierra Morena mines, whose duty it was to collect the dues levied on the ores extracted. This valuable place was in the gift of the emperor, and it is more than probable that while holding it, Drusillanus amassed his wealth.

which indicates an immense accumulation of that kind of wealth which in their prosperity the vanquished had principally received from Spain.

Describing the commerce and enumerating the riches of the proud city of Tyre, at the same time that he foretold her irrevocable doom, the prophet Ezekiel (chap. xxvii. v. 12) uses these words "Tarshish was thy merchant, by reason of the multitude of all kinds of riches, with silver, iron, tin and lead they traded to thy ports." Doubts exist among commentators on the Bible as to where Tarshish was situated. The Catholics understand it as referring to Carthage or the Carthaginians, and hence the above passage in the Douai Bible is translated thus: "The Carthaginians, thy merchants, supplied thy fairs with a multitude of all kinds of riches, with silver, iron, tin and lead." This version is evidently erroneous, other passages in Scripture, as well as in profane history, distinctly proving that Tarshish was a distant mart frequented by Mediterranean traders, which some expositors imagine corresponded to Carteia or Calpe, while others think it might have been Erythea (Cadiz), where the monster Geryon, killed by Hercules, had his abode. Antiquaries of our own, misled no doubt by the words above quoted, pretend that Tarshish meant the Cassiterides, the Scilly Islands, or part of Cornwall, because there, we are told, that the Phœnicians traded for "the English metal tin."

Rodrigo Caro employs a whole chapter to show that the city or mart of Tartessus, variously called Tharsis and Tarshish, was situated on an island near the mouth of the Bœtis (Guadalquivir) and since swallowed up by the sea, and quotes various authorities in support of his assertion[a]. The earlier ancients certainly knew the Bœtis under the name of Tartessus, and in the fourth book of his history Herodotus informs us that the Greeks went from the island of Samos to Tartessus, which they found to be like a fair, filled with riches, and till then not having been a point of attraction to foreigners, (he adds,) that the Samiots thence carried home with them more valuables than before had been seen in Greece. It therefore must have been a trading place of note, more especially for metals, which exactly corresponds with the character of the country round Hispalis, or Seville, and it is also presumable that access to it was easy. Strabo gives us to understand, that Tartessus stood only a short distance from Cadiz, and Pliny, that it was in front of that place. Avienus the poet, a Spaniard, and who assures us that he had visited the spot, says, that the island of Tartessus is formed by two branches of the river of the same name, in its passage to the sea[b].

There is therefore every reason to conclude, that this empo-

[a] Antiquedades de Sevilla, 1634.

[b] Avienus (Rufus Festus) De Ora Maritima. He flourished in the fifth century, under Theodosius.

rium of the ancients extended from the extremity of the southern bank of the Guadalquivir, a little above which now stands the town of San Lucar de Barrameda, round along the coast in front of Chipiona and as far as Rota, the point of the bay opposite to Cadiz, where the appearance of the shore warrants the belief that a large piece of land, at one time insulated by a branch of the Guadalquivir, has been submerged, and over which the sea now breaks with great violence. The Phœnicians, it is supposed, first called the place Gadir, which Avienus thus corrects, "Hic Gadir urbs est dicta, sed Tartessus prius." Sallust also says, Tartessum Hispaniæ civitatem quam nunc Tyrii, mutato nomine, Gadir habent." Anacreon alludes to there having been a king of Tartessus, and certainly it must have been a place of importance, when both Ovid and Martial call the Bœtican province by the name of Tartessica. Why it was confounded with Carteia is strange. Silius Italicus, born near the spot[a], speaking of the contingencies of native troops employed in the Punic war, in reference to that place, says, "Argantoniacos armat Carteia nepotes," and immediately afterwards, in the way of distinction, remarks thus: "Armat Tartessus, stabulanti conscia Phœbo." This island being long known to the ancients as the most western part of the globe, there they imagined that the sun set. The idea of the name being applicable to any part of Cornwall is preposterous. Tin is not a monopoly of ours, it abounds in Spain, and although the Phœnicians may at some time have bought it in our ports, this metal is mentioned by Homer, consequently its uses must have been known to the ancients previous to the Trojan war. It is, indeed, probable that, through their intercourse with the Turdetani, the Phœnicians became acquainted with it long before they extended their navigation to our shores.

In reference to the reports which had reached Judas Maccabeus of the great undertakings, achieved by the Romans, it is stated in Maccabees, book i. v. 3, "That he had also heard what they had done in the country of Spain, for the winning of the mines of gold and silver which are there." This must allude to the gigantic works in which the Romans were there engaged in order to procure the precious metals, seemingly a circumstance of public notoriety in those days. Modern discoveries incontestibly prove that the Rio Tinto mines were worked by the Romans, and certainly the existing vestiges, consisting of cavities, ventilating shafts, adits, galleries and hills of slag, there seen, present one of the largest and most astonishing specimens of ancient mining to be found in any part of Europe. The whole of these works, however, are not to be attributed to the Romans, there being every reason to believe

[a] He was born at Italica, a Roman town now in ruins, situated on the right bank of the river, a little above Seville.

that the Turdetani, the Phœnicians, and next the Carthaginians, preceded them upon this spot.

The locality is curious, and its history in no ordinary degree interesting. The mines of Rio Tinto (Red River) are situated near a modern village bearing the same name, and about eleven leagues from Seville. This village is surrounded by high hills, one of which, standing to the west and south, has been half cut down and levelled, as it is supposed, by the Romans, for the performance of their athletic exercises. Towards the north rises a loftier hill crowned with a castle, and having a cistern in the centre, which stronghold is encircled by the mouldering remains of massive walls. This remarkable spot is called "Solomon's Mount and Castle," and the received tradition in the country avers, that hither the people of that renowned monarch were in the habit of coming in search of metals, which would almost confirm what is said of his maritime enterprises in Chronicles, Book II. chap. ix. v. 21:—"For the king's ships went to Tarshish, in every three years once, bringing gold, silver, ivory, apes, and peacocks." The circumstance of apes being mentioned as part of the returns, would not invalidate the construction above attempted. These animals, of a large size, may be still seen at the back of Gibraltar Rock, and formerly they might have existed in other parts of Andalusia. In the neighbourhood is a small town, called Salamea, the derivation of which cannot be mistaken; and near it are the village of *Abiud*, and the river *Odiel*, both supposed to be Hebrew words.

On the top of Solomon's Mount opens a large and deep shaft, from the sides of which levels have been driven, and on the northern declivity is seen the mouth of an old mine, situated near a cavern, and constantly overflowed. From this cavity issues a stream, strongly impregnated with sulphate of copper, which gives to the water a deep yellow colour inclining to red. This is the source of the Rio Tinto, which, after being joined by several tributary streams, falls into the sea at Huelva. The head waters of this spring are so poisonous that neither fish nor insects can live in them, the plants washed by them wither, and even the roots acquire a deep tinge. In this and other respects the Rio Tinto locality, although on an immensely larger scale, resembles the Pary's Mine, in Anglesea, and the principal origin of Lord Dinorben's property. This spot was once almost a mountain of copper, the very streams issuing from which were so much blended with the ore, that it was found worth while to precipitate it from the water by means of a chemical process. The Pary's mine has been worked out, and no valuable discovery of the same kind of ore made in the neighbourhood, whereas those of Rio Tinto appear to be inexhaustible.

The Goths and Moors successively worked mines in Spain. Local records sufficiently testify that the gold mines of Granada afforded a revenue to the Mahometan rulers, equal to 1,606,000

rials, or £33,500 annually, and with the metal thence obtained, they coined their *doblones sahenes*, a well known coin of the purest gold, which continued in circulation among the Spaniards till the year 1753, and is still found in the cabinets of the curious. It is equally well ascertained that the Moors worked mines upon several other localities, the vestiges of which are easily distinguished from those of the Romans, who dug their shafts round, whereas the former sunk them square. The contrast is particularly striking in the copper mines of Rio Tinto, dug by the Romans, and those of lead at Linares, where the Moors left behind them many remarkable excavations.

The mining system of the ancients, as before remarked, compared with the modern one, evidently was most imperfect, and necessarily attended with great waste. It must, however, be confessed, that they laboured under great disadvantages. The use of the compass and gunpowder were unknown to them, and in the reduction of ores they derived little or no assistance from chemistry. As regards mining and smelting, Spain evidently was their great theatre of action. There, most probably, they learnt from the natives the pursuit of mine adventuring, and if they carried on works for their own account, the labour was performed by large gangs of slaves, or subdued natives, pressed into their service. Part of their revenue, it is also presumable, was derived from dues paid by the country miners. The Spaniards seem always to have retained a taste for mining, to whom, like the tending of sheep, it was a congenial occupation, and who, besides encouraging traditions, had the evidence of mineral wealth constantly before their eyes. The wars, however, in which for nearly a period of seven centuries they were engaged with the Moors, prevented them from pursuing this branch of industry with vigour, and soon after the fall of Granada the discovery of America occurred, to which country their attention was preferably directed. They then seemed to forget that they had valuable mines of their own at home, so eager were they to go and seek for gold and silver in Mexico and Peru.

ON THE ABERRATIONS OF THE MARINER'S COMPASS ON BOARD SHIP,

OCCASIONED BY LOCAL MAGNETISM.

By C. E. Borrow.

Having read with much interest the several papers of Mr. Walker, upon the subject of magnetism, and the compass on board ships, I am induced to offer a few remarks upon the same, especially the March number of the Nautical Magazine,

wherein Mr. Walker details his method of correcting what he calls the induced, but which I prefer to name the local magnetism of the ship, as affecting the binnacle compass.

Mr. Walker has ascribed the oscillations of the needle on board ship, in his former papers, to a change of the meridian of the local magnetism, arising from the guns, chain cables, iron tanks, &c., &c., during the rolling of a vessel. Independent of this change, there generally appears a greater degree of local attraction on one side of the vessel than on the other in smooth water. The mode at present adopted by the Admiralty, is by placing magnetised chain or iron bars on each side of the steering compass, in proportion as the prevalence of local attraction might appear by the test of swinging the ship round.

Whatever may be the cause of these disturbances, either in direction or intensity, it is quite clear, from the manifold instances of vessels being lost by running on shore, or on rocks, when they thought themselves perfectly secure, in trusting to the indications of their compass, that the evil is unremedied. It is therefore desirable that some more secure method should be adopted, in order, if possible, to render the compass as safe a guide as it was before the introduction of so much iron into the equipment of vessels. Some trials have been made to accomplish this, by placing a box or ring of iron round the compass, by which the local magnetism of the ship might be attracted or neutralized, but this has been found not to be effectual, at least in a rough sea, where one day's aberration may occasion fatal results in the calculation. The excellence of the chronometer, without the aid of solar or stellar observations during hazy weather, is of little avail with a deranged compass.

Mr. Walker has decried any attempt, in his observations upon Professor Airey's letter, to produce rectification by permanent magnets or magnetised iron, and he now proposes to accomplish the formation of an effective compass, independent of all local magnetism, by eight parallel needles, fixed to the compass card; but he does not state whether the poles of these eight needles are to be all north and south, or whether they are to be alternately so disposed.

Passing over the assertion of Mr. Walker, that the great oscillations of the steering compass in a rolling sea are owing to the change of meridian of the local magnetism of the ship occasioning a different direction in the force of that magnetism, or whether it may not quite as reasonably be ascribed to the sudden lurches of the vessel acting mechanically on the jimbals or universal joint, on which the compass box is suspended, I will proceed to examine the position he has now taken, by the process of eight needles placed parallel to each other on the compass card. Taking them, therefore, from deficiency of statement, either as all north and south, or all placed alternately—

My reasons for doubting the efficacy of either arrangement, were these:—

1st. If the needles were all north poles, and all south poles, they must be considered as one magnet of greater power than a single needle; but that this increase of power would overcome the local magnetic attraction, by greater intensity of attraction to the terrestrial magnetic meridian, I did not believe.

2nd. If the needles were placed north and south poles alternately, it appeared to me very possible that they might neutralize each other, and thereby affect their real polarity. I therefore procured eight magnets, five inches long, and a quarter of an inch square, strong enough by their magnetism to sustain each other, and having placed them in suspension, the following results were noted and tabulated. First, as to polarity, and deflection occasioned by a magnet of ten inches long, half an inch broad, and a quarter of an inch thick, placed at different distances from them, as a substitute for the local attraction of a ship. In this table the north poles of these magnets were all placed south, and the south north, beginning with two magnets, and proceeding to four and eight. The magnets were placed in each instance at 15° from the true polarity, and allowed to regain their polarity; and the testing magnet in the direction of an angle of 45° from the true polarity also.

TABLE I.

Number of Magnets.	Amount of deflection when the testing magnet was placed at twelve inches' distance.	Amount of deflection when the testing magnet was placed at six inches' distance.	Amount of deflection when the testing magnet was placed at three inches' distance.
Two magnets.	No deflection from their polarity.	12 degrees deflected.	25 degrees deflected.
Four magnets.	No deflection from their polarity.	15 degrees deflected.	30 degrees deflected.
Eight magnets. .	Deflected 15 degrees.	30 degrees deflected.	39 degrees deflected.

The results here appear to shew that, with no substitute for local attraction, the magnets were true in course to their polarity; but when the testing magnet was applied, the deflec-

tion or aberration was in proportion to its proximity, and where the number of magnets were increased to eight, the deflection was not only greatest at all distances, but manifested 15° at 12 inches, by which we may infer that the greater the number of magnets, the greater will be the action of local magnetism. The oscillations were moderate, and requiring about five minutes in each instance to arrive at their true polarity, before the application of the testing magnet.

I then placed the magnets north and south alternately, about 15° from the true polarity, in order to see if they would attain it. When that point was determined, they were placed, in all instances, on the true polar line, in order to try the deflecting power of the testing magnet.

Number of Magnets.	Distance of the testing magnet twelve inches.	Distance of the testing magnet six inches.	Distance of the testing magnet three inches.
Two magnets.	No polarity. No deflection.	No deflection.	No deflection.
Three magnets, two norths one south.	Eight degrees' deflection.	Fifteen degrees' deflection.	Twenty-five degrees' deflection.
	Note.—The two norths being placed at the south, the magnets came round; and when the testing magnet was applied, gave deflections as above.		
Four magnets, two norths two souths.	No polarity. No deflection.	No deflection.	Nine degrees' deflection.
Five magnets, three norths two souths.	No deflection.	Deflected twelve degrees.	Deflected eighteen degrees.
	Placed at fifteen degrees from polarity, made two oscillations of fifteen degrees, and then stopped at their true polarity.		
Six magnets, three norths three souths.	No polarity. No deflection.	Fifteen degrees' deflection.	Eighteen degrees' deflection.
	Being placed twenty degrees out of the pole, they never stirred.		
Seven magnets, four norths three souths.	No deflection.	Twenty-two degrees' deflection.	Thirty degrees' deflection.
	Four north poles being placed to the south, and three south ones to the north, the four north poles came round and found their polarity.		
Eight magnets, north and south alternate.	No polarity. No deflection.	Twenty-two degrees' deflection.	Thirty degrees' deflection.

Here it will be observed, that when the testing magnet was at 12 inches' distance no deflection occurred in any instance. When reduced to 6 inches, deflection was manifested in the odd numbers, and increased, when further reduced to 3 inches, in the odd numbers. No deflection took place in the even numbers until six magnets were used, when 15° deflection took place at 6 inches; and 22° deflection at 6 inches when eight were used.

The rates of deflection varied also according as the magnets had a larger proportion of north poles, as the south pole of the testing magnet was always projected towards them; thereby exerting a greater attraction over the increased number of opposite poles; but when the poles were equally north and south the testing magnet had not equal power over them, they apparently paralysing each other, and the action of the testing magnet appeared to be no more than might be expected when its operation was confined to unmagnetised iron.

If there is any slight anomaly in the degree of deflection or polarity, it may perhaps be attributed to the greater intensity of attraction in one magnet over another, so that in a number of magnets the attractions may not be so equally balanced but that the joint poles of the whole mass may form an aggregate, possessing a greater degree of affinity to the magnetic meridian, than if the whole individual ones were separately balanced; as it is known that, in the tempering of steel bars, it is very difficult to arrive at one and the same degree of hardness in any given number, without being finally tested; and we are well assured that a well tempered magnet will retain its power much longer than a piece of soft iron. We may here observe, this being the case, an inequality may arise after a time which did not primarily exist; so that a set of magnets being accurately adjusted, may soon assume a different degree of ultimate energy. On the whole, it would appear by the foregoing experiments, that Mr. Walker has overcome the effect of local attraction by incurring a worse evil, viz. a decrease of attraction to the true magnetic meridian, and a sluggish compass card. As a proof, however, of the efficacy of Mr. Walker's method, it is added, that the oscillations of this family of needles are considerably less during a given space of time than those of a single needle, and therefore it is concluded that their direction in a line of terrestrial magnetism is more efficient. Now this struck me— That whether from the weight of the needles, or other causes, the compass card is merely less lively, an effect that may be produced quite as soon by a wooden or a rusty pivot; I cannot understand why a brass cone, with a pivot fixed to the top, should have any stress laid upon it.

Mr. Walker is entirely incorrect in stating that the disturbance of the compass is often occasioned by a vessel descending in a rough sea 20 feet in a second; for he will find, on refer-

ence to hydrostatic experiments, that water does not fall through the atmosphere, where there is no obstruction whatsoever, more than 16 feet in the first second of time, and that the descent of a wave, surrounded by others, cannot be more than 10 feet in a second. Mr. Walker may be as wide in his expected results from the combination of needles on his compass card, as he is in his statement of the velocity of a ship's movement in a rough sea. But if Mr. Walker objects to this, and says that the onward course of the vessel before the wind should be taken into account, then I answer, that when men condescend to facts and figures, they should be cautious of what they advance, for if 20 feet per second be carried out, it will be found to amount to 13 miles and three quarters per hour, a rate to which no sailing vessel of either France or America has hitherto attained, still less the more unscientifically constructed vessels, as far as their sailing properties are concerned, of the British navy.

Perhaps it may be asked, what does a woman know of scientific matters? But have we not before us the instance of Mrs. Somerville, whose microscopic discoveries have opened new fields of wonder and delight, and even made us familiar with the organization of the future oak in an acorn, and the walnut and the hazel in a nutshell? Further, how ingeniously has she extended the discovery of Dr. Marochini, who, in 1813, found that the violet rays of the solar spectrum possessed the property of magnetising needles. Mrs. Somerville produced the same effect also, though in a less degree, from the blue and green; whilst the yellow, orange, red, and calorific rays had no such influence, even when the experiments were continued for three successive days, although she observed that the result was only attainable between ten and one o'clock. I am bound, however, to observe, that many others have in this country failed to produce any effect; perhaps from a deficiency of solar heat during the time which they selected for their experiments; but the fact of magnetism being so induced is undoubted. If the magnetism be derived by natural means from light, and its operations on the atmosphere, perhaps it is erroneous to speak of the dip, as it is called, of the south pole of the needle towards the north pole of the earth, but rather we ought to speak of the *rise* of the north pole of the magnet towards the zenith, and the dip of the south pole must follow.

The Chinese, who were acquainted with the use of the compass many centuries before the Western World, have always attributed the rise of the needle to some attraction in the atmosphere. I will only suggest one other remark on this subject, that if the attracting power was in the earth in some imaginary line, we should not witness the oscillation or precession of this line, alternately 24° east, and 24° west in a century or two. However, I merely throw out the hint; the question of rise or dip is not material to the present subject. That the

power of attraction exists is certain, and that it is liable to disturbance from local magnetism. Whether an antidote to this last and great source of mischief can be discovered, is yet doubtful; I must here add that I have succeeded in obviating, to a very great extent, the local influence of the iron of a vessel, without diminishing the true polarity of the needle in the least, and if I am finally successful, I shall have much pleasure in announcing the discovery of an effectual compass protection.

CONTRIBUTIONS TO ETHNOLOGY.

HISTORY OF THE PRIMITIVE OCEANIC AND AMERICAN TRIBES.

BY M. GUSTAVE D'EICHTHAL.

THE Polynesian and Australasian region, which comprehends one fifth part of the world, geographers have termed *l'Océanie*, a title it justly merits, not only from its position, but from the originality of its natural character, and the importance of the interests of which it has been destined to become the centre. Large, inclosed, and defended from foreign invasion by a combination of protecting causes, which will be found in no other part of the globe, it was, in the sixteenth century, overrun by the Spanish and Portuguese, who encountered each other in the act of pushing their discoveries from east to west to the very antipodes of Europe. Explored and colonized, not only by these nations, but by the English, Dutch, Chinese, and French, l'Océanie is now peopled by the earliest representatives of civilization, who have mingled among, so as almost to become identified with, the indigenous inhabitants of this portion of the globe. From the remotest antiquity, l'Océanie appears to have possessed a peculiar civilization; simple, but very regular and complete in itself, which, confined at first to Polynesia (strictly so called), extended gradually through the western region, and exercised a real influence in the development of other civilization, which we only now begin to recognise. In the north-west of Africa, I have, in a former memoir, endeavoured to demonstrate, that a nation preponderates which is distinguished, in its generic characters, in the most remarkable manner, from the blacks, properly so called;—that the Foulahs have descended more or less directly from the Polynesians, and have carried into Africa the elements of their language and civilization. It is not only among the Foulahs that I have recognised traces, more or less numerous, more or less marked, of Polynesian civilization and language, but in ancient Egypt among the Mandingoes; and, in a less degree, among various African races.

The boundaries of Oceania are in reality those of the great ocean itself; that is to say, the shores of Africa to the west, America to the east, the south pole to the south, and the Asiatic continent to the north. Upon this zone, which from

east to west comprises not less than 240 degrees,—that is, two-thirds of the terrestrial circumference,—are found scattered innumerable islands, isolated, or collected in groups, of which one is only a rock, or a mass of rocks; while others, such as Borneo, Celebes, Java, Sumatra, Madagascar, New Guinea, are among the number of the largest known islands, one of which, Australia, on account of its magnitude, is regarded as a continent. This vast oceanic region is besides distributed into four principal sections, distinguished either by their geographical conditions, or by the character of the people who inhabit it.

To the east, Polynesia, properly so called, comprehending the Archipelago of the Society, Sandwich, and New Zealand; to the south, Melanesia, comprising Australia and the territory inhabited by the blacks; towards the north, Micronesia, comprising Carolina and the Ladrones; and to the west the Indian Archipelago, to which, notwithstanding the distance which separates it, may be added the island of Madagascar. Two races quite distinct divide the habitation of these various countries, a black race, generally inferior to the African blacks, but which is not distinguished from them by any essential character, and a race of a brown or dusky colour, which approaches in many respects to the Caucasian variety. The blacks extend from Van Diemen's Land and Australia, where they appear in the lowest degradation, as far as the Indian Archipelago, and almost to the island of Malacca. It is probable that this same race also existed in Southern India, and is the source of the great number of black individuals we still meet there, especially among the lower castes. The brown or Polynesian race possessed exclusively the islands of Eastern Polynesia, and especially the Archipelago of New Zealand, the Society and Sandwich Islands. This race has appeared in all parts of Polynesia where Europeans have met them with a singular homogeneousness with respect to costume, physical features, and language. Tribes separated one from the other by vast extent of sea, and who had no knowlege of each other, could, when they were placed in communication by Europeans, comprehend and converse with each other. Carried away by the currents and trade winds which in the latitudes between the tropics of the Pacific constantly blow from the east, assisted then by the monsoon of the Indian seas, the Polynesians extended their migrations to the west, across the Moluccas, as far as the Indian Archipelago, and still further to Madagascar, where they passed into Africa. The navigators who, towards the close of the last century, explored for the first time in a scientific manner the whole of Oceania, and who passed through them from west to east by the Indian seas, in observing the striking similarity of the languages and customs of the natives upon this vast extent, at first mistook the natural direction in which they had emigrated: they thought they had, like themselves, proceeded from west to east, and deceived by the importance of a

maritime people, the most widely spread in the Archipelago, they attributed these migrations to the (Malais) Malese. But now the unanimous opinion of navigators and of ethnologists have rectified this error; it is acknowledged that Oceanic civilization could only have proceeded from east to west, and that it is derived from the Polynesians. The three men whose works have thrown most light upon the history of Polynesia are the navigator d'Urville, the missionary Ellis, and the consul Moerenhout, who agree in this opinion, whether, they say, we consider the purity and homogeneousness of the various typical characters, or whether we regard the direction of the winds and currents which drove the Polynesian continually towards the west, whilst it stopped the path of Polynesia to all those who might have attempted to enter from the west, we observe that the centre of population and likewise of civilization commonly called Polynesian, has been Eastern Polynesia. The philosopher and ethnologist finds, in this region, the only example which human annals give of a population whose development has entirely been effected within itself, and which extending itself without, has not suffered in its interior from any foreign influence. This fact, now well established, is become one of the most important bases of all ethnological research, not only to that especially relative to Polynesia, but also to that respecting the general history of the human species. It may be affirmed that all research in which the originality of Polynesian civilization is not admitted as a kind of ethnological axiom, would be found by that alone, whatever else its merit, to be destroyed at the root.

Besides, it appears, that for Polynesia there has been a separative nature which has removed all evil agents, and at the same time, the civilizing elements which have most influenced the development of others. There has not been found one ferocious or venomous beast in all Polynesia; they have only found three domestic animals, the dog, the pig, and the fowl. Polynesia has neither grain nor metals. It has lived with the cocoa nut, the bread tree, the palm, the sugar cane; all its sharp instruments have been formed of stone. Polynesia has not suffered from foreign invasion, neither has it received instruction from other nations; but the path of the sea—open to each inhabitant, the extreme facility of locomotion, the hardihood, strength and agility which resulted from their habit of navigation, brought the population, especially of the Sandwich Archipelago and Society Islands, to a remarkable degree of physical and moral development. The interest and affection with which these insular people inspired the European navigators who discovered them, is the best proof of the state of cultivation to which they had arrived. This civilization had extended to all the other islands from one common centre, which centre has not hitherto been able to be determined, and which place has possibly been destroyed. We have already mentioned the extreme similarity of language; those of

customs have not been less so; everywhere the same system of religion, the same principal gods, the same rites, the same practices, the same food and system of industry, the same games, the same arms, the same embarkation. Also the same manners and social organization, the same political hierarchy. This uniform civilization of Polynesia has been traced minutely by D'Urville in the recital of his travels, by Ellis in his Polynesian Researches, by Moerenhout, in his Travels to the islands of the Great Ocean. It appears that the Polynesians had constantly taken with them in their migrations, their religion and national customs, as well as their language; traces of it are still perceived, although in general effaced by more powerful influences. Thus we find (Touhan) among the Malese, (Touanallan,) in the island of Ternati, although the introduction successively of Hindoo and Islam worship has caused this word to disappear from the rest of the Archipelago. The singular custom, essentially peculiar to Polynesia, of rubbing nose to nose in salutation, has left traces of its existence in the languages of the Archipelago and Madagascar, and even M. de Humboldt has remarked it in the Sanscrit language.

The distinguished observers who, since Cook, have studied and described the social state of the Polynesians, have sufficiently made known the progress accomplished by them, both in industry and politics; but a thick veil still incloses their religious system. Powerful obstacles oppose the investigations of Europeans. "You ask me," says Father Matthew, in his recent publication upon the Marquesas, "for a detail of the religion of our Oceanic people; here—and I fear not to say so—of all the questions you have asked me, is the one which embarrasses me the most. The religious system of the Polynesians is the more impenetrable, because it is a mystery united intimately to the history of these people and their origin, which is still covered in deep obscurity. Besides, there is reason to believe they have lost the key to those traditions which seemed allegorical, and now, those who might have furnished the most sure information, such as the priests and the learned of the place, seldom speak thereon, by a systematic discretion, of which we can only attribute the motive to ignorance as well as superstition."

These difficulties, which in the Marquesas stopped the Europeans in the study of the indigenous religious system, were the same throughout Oceania, and especially at Otaheite, although in this island, the true religious centre, the essence and primitive legends were preserved rather more. In spite of their persevering efforts, crowned with important discoveries, travellers and English missionaries have not, however, been able to penetrate the depth of this ancient theology. An author we have already mentioned, M. Moerenhout, succeeded in enlightening this difficult subject from an unexpected source:

a man of good judgment, taking a lively interest in all subjects of Polynesian antiquity, besides being brought into contact with the natives by his quiet character, and also by commercial intercourse, he succeeded in obtaining from the ancient priests the communication of some sacred songs, the texts of which, published by him, throw a great light upon the religious system of Polynesia. These fragments contain ideas upon cosmogony extremely remarkable, and whose existence must equally astonish us, whether it belongs to a civilization anterior and superior to that which Europeans have met with in Polynesia, or whether they have emanated from this civilization itself. Here is one of these fragments, consecrated to celebrate the greatness of the supreme Polynesian god:—

"He was, Taaroa was his name; He inhabited space. No earth, no heaven, no human being; Taaroa calls, and nothing answers; and existing alone, he changes into the universe. The poles are Taaroa, the rocks are Taaroa, the sands are Taaroa. It is thus he himself has called himself.

"Taaroa is light, he is the root, he is the basis, he is the incorruptible, the mighty, who created the universe; the universe great and sacred, which is only the shell of Taaroa; it is he who places it in motion and gives it harmony."

Then the god addresses the elements:—

"You poles, you rocks, you sands, we are; come you who are to form this earth. He exhorts them, exhorts again; but these matters will not unite. Then with his right hand he lances the seven heavens to form the first basis, and light is formed; darkness exists no longer; all moves; the interior of the universe shines, the god stops, ravished in ecstasy at the sight of immensity. Immoveability has ceased, movement exists, the heavens are raised, the depths of the sea are filled; the universe is created."

One can comprehend the delight which M. Moerenhout experienced when for the first time he glanced over these fragments. "Struck with a language so new," says he, "and which I so little expected to find in these islands, I read several times this singular composition. Dazzled with this astonishing discovery, it appeared to me, at first sight, to raise at once the veil which had so long concealed from me the past."

A whole hierarchy of gods emanated from the supreme God, and from their union sprung gods and men; another primitive deity was Chaos or Night; Po, equally considered as the original of all beings; Oro and Maoui, two solar deities, charged with regulating the course of this astra, were from one end to the other of Polynesia, with some local variation, the object of worship to the natives. One extremely curious fact is, that at the solstices of winter and summer, the departure and arrival of the solar divinities were celebrated by feasts of mourning and joy analogous to those which, in the pagan world, were

celebrated at the same epoch for solemnizing the birth and death of the Grecian, Syrian aud Egyptian solar deities, Bacchus, Adonis, Osiris. The celebrated society of the Areois, according to Moerenhout, might have been primitively consecrated to this solar worship. In the islands where they had preserved to a certain extent their primitive character, the Areois passed in seclusion the months of winter, lamenting the departure of their god and his descent to the sojourn of death; they came forth again to celebrate with rejoicings the equinox of spring. The Polynesians possessed also their heroes, Hercules, whose wondrous exploits were the subjects of the songs of priests and poets.

Thus the religious fables of the Polynesians were not those commonly met with among barbarous tribes. They constituted a regular theogony, had received a great poetical development, and, what is still more remarkable, they were found again, with little modification, from one end of Polynesia to the other.

From what centre, then, emanated those dogmas, those customs, those social laws, those languages,—in fine, that race which is found so uniform upon all the islands of this vast maritime region? From what land has the root of this civilization developed itself? Was it upon one of these islands actually existing, or was it, according to local tradition, upon a continent which an immense deluge has broken and destroyed beneath its waves? A question at present unsolved, but which forms one of the most interesting problems which Ethnology can suggest.

All authors who have studied Polynesian antiquity have remarked certain affinities among these antiquities and those of the ancient world. The tradition of the Sandwich Isles relate that Taaroa, the supreme god, deposited an egg upon the waters, and that this egg in breaking produced the heavens and the earth, which is identically the celebrated Indian fable. Also the constellation of Twins bore likewise this name among the Polynesians, and had been on their part the subject of a legend analogous to this name. We have already observed that they also reckoned seven heavens. The games, weapons, the green branch of the suppliants of Greece were also found in Polynesia. The worship of the solar deities has recalled to mind, as we have said, the solar deities of Greece, Syria, and Egypt. They have also thought they have discovered some of the Chaldean traditions of Genesis: at first, that of the Deluge, but this was universal; then the history of the birth of Eve, whose name signified Osivi, in Polynesian language. This story has been related to Ellis at Otaheite; to Leddiard Nicholas at New Zealand; and although both have suspected that this pretended tradition was borrowed by the natives from the Bible, both have still regarded its authenticity still more probable. The history of Cain and Abel has been found under

other names by M. d'Urville, in the island of Tonga, and the natives, as is seen by his recital, attach to it, in an ingenious manner, the double origin of the Papuas or oriental negroes, and the brown or Malay race; the one reproached, the other blessed.

It is impossible, in our present state of information, to have any well founded opinion upon these suppositions. We may say, however, there is nothing improbable in them. Polynesian civilization appears to have belonged to remotest antiquity; at all events, it is traced up to a period prior to the dispersion of the several Polynesian tribes. Not only in Polynesia itself, but also the Indian Archipelago, as far as Madagascar, the Polynesians have been, from time immemorial, in contact with Asia and Africa. It is not, then, astonishing that they have been able, from the most ancient times, to transmit from these continents to the people, doubtless then very barbarous, some elements of their civilization.

It is certain that ancient Egypt presents some incontestible traces of a communication with the islands of the oriental Archipelago and Polynesia. This communication is not surprising or incomprehensible since, I repeat, a Polynesian colony had been settled from time immemorial in Madagascar, and the Polynesians themselves, or their civilization, had only one step to make to arrive as far as Egypt.

The agreement the most remarkable between Egypt and Polynesia is that of the name of the sun, which is the same in the two countries, Ra. It is known that the religion of Egypt, like that of Polynesia, and also of India, have been primarily solar religions, and have always preserved the impression of this primitive character. Now the vulgar name of sun among the Egyptians, was Ré, and was represented by a god called also Ré, this name became Ra, in the name of the supreme god of Egypt, Ammon Sol, or Ammon Ra. This monosyllable Ra, was identically the same which designated the name of the sun throughout Eastern Polynesia, New Zealand, the Society Islands, and Sandwich Islands; it spread with the Polynesian language itself, undergoing certain modifications from east to west of Oceania. By a singular circumstance we only find it in its primitive form of "Ra" in Egypt. Now the historical monuments of Egypt ascend to more than 3000 years before the Christian era. Civilization, the Egyptian language, were formed from this epoch. The name of the sun existed there such as it is preserved to the end. At what epoch then, could it have been introduced into the language, in the Egyptian worship, this element of Polynesia?

Perhaps it will be said this coincidence is the effect of chance. I do not think so; at least it appears to me infinitely less probable. I ought to explain the reason of this opinion.

The analogy of words is one of the surest and most powerful

means of discovery which Ethnology possesses. It is with this instrument that they have succeeded in constituting some great natural families of people, for example, Indians, Turks, and Polynesians, therefore it is very wrong to slight this means of investigation. But it must be acknowledged that it has not always been used as it ought to have been, and as it now is. At the time when the mania raged to attribute all to the Hebrew or the Celts, the learned of Europe scrupled not to torture the sense and sound of words, and draw from these mutilations ridiculous analogies. Hence the just discredit which their researches have received; but this discredit, to be legitimate, ought only to touch the abuse, it would be destructive to prevent its reasonable use. Until now, experience has shown that whenever there is a real and positive agreement between words belonging to two languages, even geographically apart, provided the sound and sense of the words agree effectively, and not merely nearly, or forced, there is great probability that these words have one common origin; and if likewise there exists other ties among the people, if some geographical or historical chain is found between them, then this probability amounts to certainty: there is infinitely less hazard than has been pretended in this analogy of words; and these analogies are presented much seldomer than is supposed. Is it necessary to cite an example? After thousands of efforts, what is the number of Basque words of which they have succeeded in finding the analogy in other languages? Have they hitherto been more successful with respect to the American languages, excepting some concordance very natural with the various languages of the North and Asia? It may then, I think, be boldly asserted, that if nothing is more insignificant than the analogy of arbitrary and forced words, on the contrary, nothing is more significant, nor points out better the relation of nations, than these same analogies when they are real, positive, and agree with the rules of wholesome criticism.

I think, then, that the co-existence among the Polynesians and Copts of a monosyllable so precise as the word Ra applied to an object so well determined as the astre of the day, cannot be attributed to any thing but a communication between the two people. And when this communication is also explained by the possibility of maritime intercourse, it becomes still more probable other similarity in language and theology are added to this. The Egyptians, like the Polynesians, place in the number of their principal deities Chaos, or primitive night, the mother of nature; they call Bouts, which corresponds exactly to the Polynesian name of night or chaos, Po, Bo, Pouds.

The two countries also possess a certain number of similar customs: thus, circumcision, which name is very like among the two people, (Tefe and Sebi); the custom of embalming, also the form of pyramids for religious usages and tombs; also

the worship paid to the solar deities, especially at the time of the spring and autumnal equinox, and the belief in a region where the soul was received after death, and which was situated in gloomy regions where the sun descended during the night and winter.

In the order of religious subjects, we may cite the analogy of the sacred words Tábou and Tonbo, Too or Thoout, idols; Tii, spirit; and Tiri, breath. Other coincidences, more or less striking, are met with in the names of objects belonging to common life; but we think it is useless to enter upon this.

We have seen that the two great divinities of Polynesia, whose worship was most widely diffused, were the two solar gods, Oro and Maouï. Is it not a singular coincidence to meet with these names among the solar gods of Egyptians, Orus or Hor, and Mouï? Struck at first with this resemblance, I wished to prove if they resembled in character, and I solicited the kindness of M. Champollion Figeac the communication of the unpublished notes of his brother, relative to the two Egyptian gods Hor and Mouï. Now here is the result of these notes: Mouï or Meou, son of the Sun, is a second form of the god Hor or Hor-phré, Horus. Sol, the name of Hor, associated to that of Mouï, becomes at once Har-Meou or Har-Mouï. This is, says Champollion, the god Horus identified with the god Meou or Mouï.

Thus we find in one part in Polynesian mythology two great solar divinities, Oro and Maouï. In Egyptian mythology we also find two great solar deities having names almost similar to the first, and besides, intimately allied as they were, derived from the same origin, Hor and Mouï. Could such a coincidence have been the effect merely of chance? It appears difficult to believe it, especially when we recall other coincidences, particularly that of the name of sun, Ra, existing between the two countries. We think it more rational to perceive in these facts the index of a very ancient communication, and besides perfectly conceivable, between Egypt and Polynesia.

Other striking analogies are met with in Egypt and another part of Oceania, the Indian Archipelago. Such, in the first place, the name of their fruit trees, which is by placing before the names of the fruit, in Coptic, the word *bô*, and in the dialects of the Archipelago and Madagascar, the same word slightly changed to the form *vo*, *voa*, *bou*, *boua*, &c. Thus it is that the vine is called in Coptic *bo-n-aloli*, and in the language of Madagascar *voa-lomb*. The name of the Egyptian god goat, *mendès* or *mend*, is that of the goat in ancient Javanese, *mendo*. The name of the sacred serpent, *ouraus*, recalls that of the serpent in all the Archipelago, *oular*, *orrai*. The word *cham-é*, black in the Coptic, is *cham-ang* in the language of Java. It is known that the Egyptians adopted yellow for the conven-

tional colour in the figure of women ; now yellow, the shade of pale gold colour, is considered as the type of beauty in point of colour throughout the Archipelago.

Raffles, in examining the monuments of Soukou, in the island of Java, was struck with their resemblance to the Egyptian monuments. Is it possible, he says, to contemplate these figures without remarking the affinity which they bear to the Egyptian worship? In the monster devouring the child we find again Typhon; in the dog, Anubis; in the stork, the Ibis. The palm tree, by which the Egyptians designated the year, the pigeon, the hawk, the immense serpent, are all symbols of Egyptian worship,—the existence of the relations between ancient Egypt and India, which is doubtless not rejected. Hence, then, the existence of communications between ancient Egypt and the Archipelago is not surprising.

Other analogies have been already noticed by M. d'Urville, between Egypt and one of the islands of the Oriental Archipelago, that of Waigon, inhabited by the Papuas: "The idols which are found upon the tombs of the chiefs at Dory," says M. d'Urville, "the rings which they wear round their necks and in their ears, and their sacred house, evidently prove the traces of some worship. The cushions in wood, ornamented with two heads of the sphinx, have a perfect identity with the utensils of the same nature which are found every day in the Egyptian tombs. This similarity is such, that the first time I visited the cabinet of M. Denon, I thought these objects had been brought from New Guinea and placed by error among those of Egyptian industry. The custom of these cushions or concave stools, for resting the head upon, does not exist now in Egypt, but it is found in all Nubia; it is also general in the Oceanic isles. The Bibliothèque Royale lately possessed a cushion of this sort procured from one of the islands of the Archipelago, which was bought on account of the resemblance it bore with the analogous utensils of the Egyptian tombs.

However, the vocabulary of the Papuas, and those of other populations of the Oriental Archipelago, which we have been able to consult, does not offer any analogy of words with Egypt; but we have found some analogy of this sort in the vocabulary of Vanikoro, of this island, celebrated for having been the theatre of the shipwreck of La Perouse. We have found others still more remarkable between the same vocabulary and several words of the Madingue language. In truth the traces of Polynesian civilization which we have already met with in Africa, among the Foulahs and the Copts, is also seen among the Mandingoes.

The Madingues, or Malm-ké, are now established in the north-west of Africa, but it is known they were not originally of this region. Their name recalls those of the Malécapes (the

people of Madagascar), and even that of the Malese. Golberry, in his travels to Senegal, found their physiognomy resembling more the blacks of India than those of African Negroes.

An African tradition communicated to Clapperton by the Sultan Bello makes the Mandingues, the Copts or the remains of the Copts. I have sought to verify this indication, which has remained unnoticed in Clapperton's book, and I have found that the names of the four principal domestic animals in Mandingue, those of the dog, the horse, the sheep, the ox, are evidently derived from the Coptic. We may also notice other analogies in the two languages, but they are not sufficiently striking to mention here. Now this people, who came from the coast of Africa, who were formerly connected with the Copts, whose name and perhaps physiognomy even indicated Oceanic origin, are allied by the same language to the same origin. We have said, that the most part of the blacks of Oceania present visible traces of contact with the Polynesians. These traces consist in general in a certain number of words which belong to the Polynesian language.

They are very common words, such as those of the parts of the body, of the principal elements, of domestic animals. Now the Mandingue language possesses precisely a certain number of these words established between this language and the Polynesian, a relation quite equal to that of Polynesia with most of the languages of the Oriental Archipelago; the words *voulo* skin, *toula* ear, *gny*, tooth, *nou* nose, and some others, which are found almost identically the same in the Polynesian vocabulary. For some other analogies, more striking at first sight, would not be recognised in the Mandingue words *sighi* chief, *beune bien*, arrow. The Polynesian roots alighi and pana, are spread from one end to the other of Oceania. But when we see at Vanikoro these roots become talighi and pouene or abione, these transformations explain immediately the Mandingue words *sighi et beune bien*, are brought again to the same root.

We have then a perfect right to admit, at least as an hypothesis, that the Mandingue are a black Oceanic people thrown formerly into Africa, as the Foulahs were by the tide of migration, of which we know neither the cause or epoch.

We ought still to remark, that there are found scattered among the various blacks of Africa, from the shores of the Red Sea to those of the Atlantic, a certain number of words whose Oceanic origin is evident. Another point of evidence still more striking is, that among the people of Yarriba and of Borgon, they find again the principal Polynesian custom of burying the dead, placing them sitting, knees and elbows folded at the bottom of a circular pit. Herodotus states this custom existed in his time among the Nosamons, an African tribe whose race is now lost. Besides, a tradition related by Clapperton affirms, that the

people of Yarriba came to the shores of eastern Africa, that is to say, from the points which were the more directly in communication with Polynesia.

We have proved that a civilization entirely original, and whose primitive centre is not yet known, had existed in Polynesia at an epoch anterior to all historical tradition, the Polynesian race has spread from east to west across the Oceanic region, carrying with it its language and civilization. A few years since we had recognised as far as Madagascar, the manifest traces of this astonishing migration. We, in a preceding memoir, have shown that we must attach to Polynesia and the Archipelago the powerful race which reigns now in the north-west of Africa, and especially in Egypt, offering, in respect to religious customs and language, coincidences with Polynesia and other parts of the Oceanic. These coincidences are, it is true, few; but they appear to us sufficiently important and characteristic to add a new proof to those which already existed of an ancient communication between Oceania and Africa.

PROGRESS OF SOUTH AMERICAN CIVILIZATION.

BUENOS AYRES AND MONTE VIDEO.

In a recent number of the Polytechnic Review we drew attention to one of the most interesting regions of the world, from whence, when peace shall be allowed to scatter around the blessings of modern cultivation and refinement, the man of science will derive new sources of instruction, whilst the ethnologist may pursue his delightful avocations, and the merchants draw forth new products to add to commercial wealth. The countries bordering on the Rio de la Plata are fertile and rich in vegetable treasures. The exquisite drawings deposited in the museum of the Royal Botanic Society in the Regent's Park, by Mr. Dickson, the Consul-General from Buenos Ayres to this country, made by the great botanist, Bonpland, inspire an ardent curiosity to become acquainted with the products of that part of South America. But if Buenos Ayres and Monte Video are subjects for research, how much more so must be Paraguay, so long excluded, under the government of Francia, from any connexion with the rest of the world. This land of the Jesuits is an unsealed book, from whose leaves are yet to be distributed knowledge of no ordinary character. The wealth of her forests is partially known, the lofty timber trees afford the hardest woods, many fitted for dies, for tanning, for naval architecture, whilst some vegetable families yield medicine and food, amongst them the matè, which, made into tea, was for so long a period the favourite beverage of South America. The immediate neighbourhood of the Rio de la Plata

abounds in products which are useful to man, and down her noble stream would be borne animal, vegetable, and mineral products, which would eagerly be sought by European nations in exchange for the manufactures which are the result of art and of labour. But alas, during a series of years, a war, destructive to every kind of intercourse has been languidly carried on; it has not been one of those fierce struggles for liberty and independence, which, although all must regret, may be considered to be as inseparable from human affairs, and which the annals of all nations prove to have existed in every age.

The contention between the two states of Buenos Ayres and of Monte Video, must be a source of misfortune to the whole world, now brought together by closer ties, and to every community, more or less influencing the general happiness of the whole. The government of Buenos Ayres, at the head of which stands forth his country's great benefactor, Manuel Rosas, has long felt how necessary for the stability and happiness of the South American states, is one great confederation, having mutual affinities, mutual interests, and the same great objects in view, the preservation of their independence against the inroads of foreign aggressors. In Monte Video the same feeling exists, but it is overpowered by numerous foreigners who have taken up their residence there, who have neither the high feelings, the patriotic enthusiasm, nor the same ardent devotion to the soil as the native born South American. They would rather see the standard of France wave over their heads, than live under a national flag which would command the respect of the world. The long war that has been waged, with all its concomitant misfortunes, has been the result of foreign interference, and had the descendant of the Spaniard been allowed to act for himself, there would have been at this moment a solid confederation of all the states, powerful at home, and admired abroad. In that well known publication, entitled La Revue des deux Mondes, which deservedly holds the highest station in literature in France, but which with its bigoted political views and frequent inconsistency is less prized than it deserves from the talents it displays in its own peculiar field of knowledge, is to be found a review of the speech of Thiers, lately delivered in the French Chambers, on what it terms the great question of Monte Video. It characterizes the effort of the orator as one of unusual vigour and power: never, says the Review, was language more energetic, nor a more striking effect produced. It follows the arguments of this wild statesman with rapturous admiration, and acknowledges as its own the opinions which he recklessly avows, and which, doubtless, had he remained in power, would have been the grounds on which he would have acted, totally regardless of the truth of his assertion, and the honesty of his views. The gratuitous insult which he bestows upon the chief of an independent government, under the name of a barbarian,

is but one of those insolent epithets which men, when they are forgetful of what is becoming to others as well as to themselves, are apt to indulge in, or when they are falsifying truth, or when they hope by throwing dirt, that some of it may soil the purest. Rosas has acknowledged the independence of the province of Uruguay, and has neither interfered with the government nor the election of President; and when Oribe was raised to that station, he extended to him the hand of friendship, which he would not withdraw when he was driven by a party from Monte Video, composed of foreigners, and of those who wished to see South America once again subject to the yoke of Europeans.

Thiers, in one of those figures of speech, in which, when borne away by the wild imaginings of his fancy, he is too apt to indulge, embodies the spirit of barbarism in Oribe, and that of civilization in Riviera. Heedless of the ruthless invasion of the peaceful and tranquil provinces of Rio de la Plata, which was so wantonly commenced by the latter chieftain, he gives to him the meed of praise as the protector of freedom and of human advancement. In the midst of the torrent of words which the thoughtless statesman poured forth, was spoken the impression that actually dwells not upon his mind alone, but upon those of a vast body of his countrymen. These words have been echoed back in England, and it is to be hoped that they have not been heard without being thoroughly understood. Eighteen thousand Frenchmen, said Thiers, attracted by the richness of this magnificent soil, are established upon the river of the Banda Orientale; this maritime position is perhaps the happiest in South America; here France has created by circumstances alone, a noble colony. The triumph of Rosas, and the submission, both political and commercial, of Monte Video, would be the destruction of this new country. Yes, here spoke the Frenchman, hence we may gather why, under the directions of the Consul of France, a legion of nearly four thousand foreigners was enrolled, which, even at this hour, although called on recently by the French authorities to disband, defends Monte Video against its lawful master. A French colony at Monte Video has, we believe, long been the theme of a party of French politicians, they are as eager to possess it, as are the Russians to become masters of Constantinople; all they wish of South America, is centered there; well do they know the value of the mighty river upon whose banks two such cities are placed: whilst England is busily occupied anywhere, and everywhere but where she should be, does France stretch out her arms. She has played her game on the Mediterranean, and laughs at her own duplicity. She would do the same at the Rio de la Plata, if Rosas were not as watchful a statesman as he is a gallant soldier and an upright man. If British inter-

ests were duly studied, the vast and populous continent of South America would afford a market for our manufactures, more valuable to us than any that we possess.

Sir Woodbine Parish observes: "Amongst the people of the country districts the manufactures of England have become articles of first necessity. The Gaucho is entirely covered with them. Take and observe all his gear, examine all his dress, and whatever is not made of raw hide is English manufacture. His wife's clothing comes also from the Manchester loom; the pot in which he cooks his food, the plate from which he eats, the knife, the poncho (the cloak), the spurs, the bridle—every thing goes from England." It must be acknowledged that Rosas and his government have ever consulted the wishes and the wants of the British residents at Buenos Ayres. Libraries, reading-rooms, commercial rooms, churches, cemeteries, have been freely allowed, where other communities have been denied them. The ground on which the first church was built for English Protestants was presented by the illustrious Governor. This tolerance exhibited towards foreigners is, it must be remembered, totally at variance with the feelings which usually exist in South America, where an enthusiastic bigotry towards the religion of Spain exists in a degree almost unknown. The hospitality of Rosas and his daughter towards British officers has been of the most marked character, although it has sometimes been violated by ungenerous remarks from those towards whom they have exercised the greatest kindness. It is not our province to enter upon the political questions which have lately agitated those countries, nor to shew how diplomacy has, instead of settling the questions, rendered them more difficult; nor to animadvert upon the conduct of those who, clothed with British authority, with which they were invested for other purposes, have become almost warm and strong partisans. Sufficient for us is to point out the absolute necessity of arriving at a termination of a deadly feud which shuts out men of science from researches which must be beneficial to the world, and to call upon those who direct the energies of the country not wantonly to sacrifice advantages of no ordinary kind. Few cities possess a more salubrious climate than does Buenos Ayres; it is admirably adapted for the residence of the invalid, who has felt its influence to be greater than that of Madeira. Its beautiful position on the banks of the river, the tempered breezes that are wafted from the Pampas, contribute to make it one of the most healthy spots in the world. Although La Plata is but a river, it is thirty miles broad at Buenos Ayres; so pure and serene is the air, that sometimes the towers of La Colonia may be seen on the opposite side. This purity of the air is, however, oftentimes the precursor of four or five days of unceasing rain, and of thunder which to an European appears

of a terrific character, for it seems incessant; not the slightest intermission is observed for two or three nights and days; but again does the utmost tranquillity prevail in the air, and all is mild, soft, and balmy. The latter end of September spring commences, with an exquisite beauty of verdure and of flowers; the blossoms of the peach, the orange, and the citron tree shed around a thousand dewy odours. The Quinta is full of birds, all different from those in Europe. Even the sparrow has a gorgeous red collar round his light grey throat; there is one little species of cardinal which has a plumage exceedingly brilliant; but the queen is the humming-bird, of which, in summer, there are great abundance. They live on the sweets of flowers, and when feeding never perch, but go from flower to flower, and with their little long beak search out the nectary of each flower. They carelessly approach the windows which are left open. Most of the birds are exceedingly tame, and even the wild duck, so shy in Europe, springs up at a small distance and flies round. The horse of Buenos Ayres is one of the most extraordinary creatures; his courage and activity are remarkable, nothing startles, nothing frightens him. The women of the country ride fearlessly great distances, and trust themselves over the country on the horses, which seem instinctively to know their way. The daughter of Don Manuel Rosas rode on one occasion twenty-eight leagues on the same horse, danced the whole night, and rode home the following day; nor are such feats unusual. The society is not of a very agreeable character; for although parties assemble, there is little conversation; the theatre is the great source of amusement, there the ladies exhibit their ball costume. In general they are handsome and graceful, but their education is neglected, they are often insipid, and ignorant of every thing but that which passes immediately around them. The Carnival, which was a scene of uproarious mirth and obstreperous gaiety, has recently been interdicted by Rosas, as unworthy a nation placing itself in the first class of cultivation and refinement. Little is read, but English newspapers are published both at Monte Video and Buenos Ayres; they are abusive of the respective governments they oppose, but are written with great vigour and spirit. If a confederation of the States be actually carried out, we are persuaded that a great power may be formed, which, when duly consolidated, will play an important part amongst the nations of the world; and if England pursue the proper path, she will have fresh channels opened for her manufacturer, new lands for the research of her men of science, and scope for those mighty means of civilization, of cultivation, and refinement which she possesses, and which should spring up wherever her flag is unfurled.

IMPROVED CLEANSING OF THE STREETS.

In the last number of the Polytechnic Review are some details of the very interesting operations bearing on this important subject. A very influential public meeting has taken place at the Hanover Square Rooms, presided over by that truly estimable and philanthropic nobleman, Lord Robert Grosvenor, M.P., for the purpose of introducing throughout the extensive parish of St. George, a system of cleansing the public thoroughfares, courts and alleys, which would greatly tend to prevent the formation of mud or dust either in winter or summer, and thereby effect a remedy to evils which have for so long a period been a source of annoyance, discomfort, and injury to the public at large.

This meeting, as will be perceived by the public statements, was very respectably attended; whilst on the platform were assembled some of the leading aristocracy of the country, who evinced not only a familiar acquaintance with the many important ramifications connected with the question of well-cleansed thoroughfares, but showed by their language and their conduct an earnestness and determination to exert themselves, in order that the lamentable evils to which we have already alluded may be effectually and permanently remedied.

In accordance with this feeling, we are happy to find that some of the leading aristocracy of the country are lending their active co-operation to promote, by their personal influence, the great social improvements aimed at by the "Association for the promotion of improved Street Paving, Cleansing, Drainage," &c., which has now been in existence for the last two or three years. The most essential aid will therefore be rendered through this medium, as the very fact of the nobility and gentry devoting so much of their time and attention to subjects which have hitherto (unfortunately) been left to the management of scavengers and illiterate men, will not only remove those absurd suspicions too frequently awakened in the breasts of Boards of Vestries and Paving Boards, towards those new propositions which do not exclusively emanate from themselves, but will at once, and convincingly, show them that the evils and nuisances of which long established habits and prejudices have rendered them unconscious, are now demonstrated, by undisputed facts, to be so manifest as to demand the most active and energetic exertions towards their complete removal. Two powerful and highly respectable Boards have consequently been consulted thereon by numerous and influential deputations. And we are happy to find that the trustees of the Grosvenor district have evinced the liveliest interest on this subject; and at the very moment at which we

write, they are now employing a certain number of men, (after the manner recommended by the Association,) who are engaged throughout the day in collecting the manure which falls from the passing cattle, cleaning out the channels, and thereby maintaining a free passage for the water to run away—sweeping and preserving the road and foot pavements free from dirt or any rubbish whatever—collecting the stones that lie scattered about, and directing their attention towards the more effectual preservation and good order of the public thoroughfares generally. The gentlemen of the Paving Board of the district of St. George's, Hanover Square, are taking active measures, through the means of the vestry clerk, to collect the most ample information on this subject; whilst the gentlemen of the Paving Board of St. James's are by no means behindhand in exerting themselves to improve the condition of the streets under their control.

One very peculiar and gratifying circumstance attendant on the improvements in cleansing the streets, now so strongly recommended by the Association, is, that so far from the extra expense thereby entailed being a pecuniary burden to the rate-payers, it is clearly and incontrovertibly demonstrated, that in proportion as the sums of money devoted to cleansing the streets are augmented, so are they in a much greater ratio decreased in the cleansing of our houses, whilst this improvement will be the means of giving permanent employment to many thousands of able-bodied labourers, who from their necessities are now compelled to seek relief by becoming inmates of a workhouse or union, to the manifest destruction of a fine independent spirit, and love of obtaining their livelihood by the sweat of their brow, as well as to the prejudice of the interests of rate-payers generally, since the poors' rates must become thereby proportionably augmented. We are greatly rejoiced to hear that as the public become acquainted with the useful operations of the Street Cleansing Association, (which is perfectly honorary,) that they evince the greatest cordiality in its favour, and we hope and trust ere long that branch associations will be established in all the large towns throughout the United Kingdom

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REVIEWS.

Emigration and Colonization. By THOMAS ROLPH, Esq. London, Mortimer.

THE ardour and enthusiasm which have characterized the labours of Dr. Rolph in favour of systematic colonization, merit for him the praise of all those who feel the welfare of their coun-

try at heart. It is a matter to be regretted that, notwithstanding all that has been done by companies and by private individuals, no step worthy a great nation has been taken by the government for the twofold purpose of relieving the country of a superabundant population, and of securing to our colonies an industrious, active race of inhabitants. The experience of all ages has proved that there is a necessity in certain stages of the prosperity of a nation to send out from its body a youthful swarm, ready to carry the arts and sciences of their mother-land into regions advantageously situated, which require protection and support. Alike the Roman and the barbarian felt this necessity, and acted upon great and enlarged views, sending forth their sons to benefit themselves and the world at large. The first person who, in the House of Commons, introduced this subject, was Sir Francis Burdett, some years since: he was listened to with coldness within the walls, and without he was assailed, epecially by Cobbett, for entertaining the idea of banishing to remote regions the inhabitants of the country. This fallacious view has, however, been abandoned; but whilst all are alive to the policy, nay, even the necessity, of taking some active measure for systematic emigration, the Government calmly looks on, and probably throws impediments in the way of those who with hopes of success would venture to act independently. The Minister of the Crown has been solemnly appealed to by the most influential merchants of London, to assist them in devising means to promote emigration and colonization. Companies have been formed for the purchase of land which they might sell in small lots, after having made roads, canals, and prepared their purchase for occupation by such persons who, possessing industry and zeal, have but limited means to obtain subsistence and the ordinary comforts of life. Whilst some have sought far distant lands, others have looked nearer to their native home, and the colonies of British North America, from their extent, their importance, and their value, have naturally claimed a large share of attention. In Upper Canada, a Company has been formed which has successfully carried out its objects, and which will yet give wealth to its projectors, and the means of honest livelihood to its clients. In Lower Canada, the Association has wofully mismanaged its means: possessing a beautiful tract of land, equal to the best valleys in Europe, it has deserved only reprobation, and has been as unfortunate to those who embarked in its views, as it has been useless to those for whose benefit it was principally intended. Dr. Rolph demonstrates, in his work, that the unremunerative capital of England, the unemployed population of the United Kingdom, and the unproductive lands of British America, are the three elements to combine and carry on a most useful and most profitable scheme of colonization; and that it

is in their wise conjunction that the only difficulty lies: for this end, the British American Association was formed, a narrative of its rise, its progress, and its fate, occupies the principal portion of Dr. Rolph's volume. He looks to its renovation, to its rising phœnix-like from its ashes, and assuredly we believe that something must be done which may make Canada one of the means of upholding the grandeur and integrity of the British empire.

Our Actresses.—By Mrs. C. Baron Wilson. London, Smith, Elder, and Co.

Mrs. Cornwell Baron Wilson, a lady whose name is already familar to the lovers of dramatic literature from her having written the life of the Duchess of St. Alban's, has undertaken to furnish the public with the memoirs of some of those favourites who have flitted their hours upon the stage, and of others who still remain to instruct and amuse us. It may be considered to be somewhat an invidious task to comment upon those who have not yet ceased to exist. The biography of those who are still living is seldom correct, for on one hand is the fear of offending, and on the other, the lurking desire to flatter. Mrs. Wilson has, however, executed her task with considerable skill; we think that both the public and the individuals who are the subject of inquiry, will feel satisfied with the verdicts she has pronounced, and with her general impartiality. Some research is of course necessary for those who have been almost forgotten, but in this Mrs. Wilson has been unremitting, and we think that her work will prove acceptable. We will merely give as an example some of what she has recorded of two of our favourite actresses.

MRS. NISBET.

"It is customary with those struggling members of the theatrical profession who have young families, to endeavour to make them useful at as early a period as possible, and thereby win on the public boards that money which is too often much wanted at home. Such was the case with the father of our heroine; or, we should rather say, her mother, who was a most estimable woman in all her domestic relations, and fortunately possessed that quality which her gay husband had not; namely, prudence. Pretty little Louisa Mordaunt evinced much of that precocious talent which is usually admired in children; and she studied, was tutored, and acted a variety of the juvenile characters in tragedy, comedy, farce, and interlude.

"After a few years, we find her at the then Lyceum theatre, in the Strand, acting, for some person's benefit, the part of Jane Shore; and advertised as a sort of theatrical wonder, she being

but ten years of age. 'A ten years old Jane Shore!' Can absurdity go further? Yet it was what might be termed a clever absurdity. The child was clever, the absurdity was in those who placed her in so unnatural a position; and we presume their reply to our assertion will be, like that of Shakspeare's starving apothecary, 'my poverty, not my will consented!' and as John Bull paid for it, he made no nice distinction between the will and the deed.

"About six years after this, (during which time she had studied hard, and practised incessantly, and in a great measure contributed to the support of her numerous family,) Miss Mordaunt made her curtsey as a 'woman,' on the boards of the Theatre Royal, Drury Lane, under the management of Mr. Stephen Price. She was in her sixteenth year, although in personal appearance she might have passed as a splendid woman of three-and-twenty! The play selected for her debut was poor Cherry's comedy, of rather doubtful excellence, 'The Soldier's Daughter,' in which she sustained the part of the Widow Cheerly. Much interest had been excited in certain quarters, and amongst her aristocratic relatives there seemed every inclination to promote the professional welfare of the young and dashing *débutante*.

"She was in reality the character she represented, 'The Soldier's Daughter;' and it was also one exactly suited to her powers, for they had not then sufficiently developed themselves. She appeared, and was loudly cheered by a most brilliant house; and when the curtain fell upon an epilogue, (many lines of which strongly bore upon her own peculiar situation,) her success as an actress was decided, and her engagement with the management was secured.

"Among those of her aristocratic relatives who were active in their patronage of her efforts, and visited the green-room to congratulate her on her success, was her aunt, the once splendid beauty, Lady Cranstoun."

MADAME VESTRIS.

"Armand Vestris first appeared in London in a pas de deux with Madame Angiolini, in 1809, in a ballet called 'Les Amours de Glanque.' He then danced a fandango, with Angiolini, in 'Don Quichotte, ou les noces de Gamache;' which fandango, it was said, turned the heads of half the female portion of the audience. He was just two-and-twenty, but was fast sinking into old age from his dissipated course of life. Vestris reposed quietly in the good graces of the fashionable world; and on one eventful evening, (fatal, alas! to her future peace and happiness,) Eliza Bartolozzi 'sighed and looked, and looked and sighed again,'—then fairly owned herself 'danced out of her heart.'

"What man on earth could have resisted such a pair of eyes

as then sparkled in the head of the most fascinating girl in England? Armand Vestris could not; but, alas! the poet hath said, 'Violent commencements have violent ends!' We must not, however, anticipate. It is sufficient here to say, that their marriage took place at St. Martin's-in-the-Fields, on the 28th of January, 1813.

"As many of our readers might not remember the once 'admired of all admirers,' Monsieur Armand Vestris, we will give a personal sketch of him, as he then appeared. He was rather of a clumsy make, and by no means the man that a casual observer would fix upon to put in training either for a dancer or an Adonis. His visage was chubby and inexpressive, and his eye had an expression of dissipation that was displeasing. It was the gloating of passion without its fire.

"He lived expensively; and as the charms of his young wife began to be much lauded, he determined to bring her on the stage—to which the lady was perfectly agreeable. She required but little preparation; and, after receiving a few lessons in singing from Mr. Corri, made her first appearance for her husband's benefit, at the Italian Opera House, on the 20th July, 1815, in Winter's beautiful opera of 'Il Ratto di Proserpina!' This was a bold undertaking, since the part had been composed expressly for Grassini, and her excellence in it was still vividly recollected by the public. The youth and beauty of Madame Vestris, however, atoned for her deficiency in point of talent, and she made a most favourable impression upon a very crowded audience; she was encored in one duet, and warmly applauded in several airs."

It is gratifying to find that so many of our English actresses have borne an unsullied reputation, and that they have deservedly found a place amongst the highest in the land. For although we are not willing to consider the stage a school of morals for those who are actively engaged in its progress, still, as representatives of the highest feelings which adorn human nature, we should like to know that they are themselves worthy to be ranked amongst the good and the virtuous. Mrs. Wilson is a good English writer: her style is pure, her diction sufficiently ornamented, and she may be fairly ranked amongst those who have enriched our language with good plain sense and authentic information on many points.

FINE ARTS.

BYRON'S STATUE BY THORWALDSEN.

It is gratifying to learn that no accident has befallen, as was feared, the statue of our great modern poet, which was chiselled by the great Danish sculptor, Thorwaldsen. We look with

anxious hope to see it placed in some spot worthy the age in which we live, and where neither intolerance nor bigotry can reach. We have in our former numbers pointed out the advantage which would accrue to us as a nation, if we had some building in which could be deposited the resemblances of those mighty men who have adorned the age in which they lived. Some Pantheon, within whose walls should be ranged, for the admiration of posterity, and as an incitement to good and virtuous deeds, busts and paintings of those who have passed away from us, and have left their memorials in a nation's heart. The discussion on the subject of Lord Byron's statue in the House of Lords ought to have elicited some of those sparks of generous enthusiasm which the leaders of a nation ought to feel; but it was dull, flat, and insipid.

WILKIE'S MONUMENT.

Another memorial, besides the one in the National Gallery, has been raised to the memory of David Wilkie. It is erected in the church of Cults, and is said to be an exquisite work of art, designed and executed by a man whose powers of mind, brilliant imagination, correct taste, accurate principles, and good judgement, are all fully brought out in the admirable and striking likeness of Sir David. The drapery is in excellent harmony with the other parts of the monument. The inscription is as follows:—"Sacred to the Memory of Sir David Wilkie, R.A., Principal Painter in Ordinary in England, and Limner for Scotland, to King George IV., King William IV., and Queen Victoria. Born at Cults, 18th of November, 1785. Died 1st of June, 1841; buried at sea, off Cape Trafalgar. As the painter of domestic scenes, his works were the ornament alike of the palace and the cottage. Through life he was guided and animated by those sacred principles to which he had often listened, when a boy, in this place, from a father's lips. In order to acquire the accurate means of illustrating by his art the history of our Saviour, he departed for the Holy Land, and died on the homeward voyage. The Tablet is erected by his affectionate sister in 1844." Sir David Wilkie is placed on the east, and the monument to his father and mother, by Chantrey, on the west of the pulpit, each of them within a few inches of it.

EXHIBITION AT PARIS.—MANUFACTURE OF PORCELAIN.

The exhibition of the works of art manufactured at Sèvres, has called forth the loudest expressions of admiration from the Parisians; and certainly nothing that has emanated from Dresden or Berlin can surpass the splendid specimens of porcelain which have adorned the gallery of display during this year. In 1738, the Marquis of Fulvy, the commandant of the castle at Vincennes, spent a large fortune upon an establishment for

the manufacture of the fine kind of pottery, to which the name porcelain is attached. This was carried on at Vincennes until the Farmers General became the proprietors, and then removed it to the present magnificent manufactory at Sèvres. In 1759 it became the property of Louis the XIVth, and has ever since formed a part of the domain of the crown. It has been watched over incessantly by men of ingenuity and acquainted with the progress of art, several distinguished chemists having from time to time devoted the whole of their energies to its improvement. In England, the unremitting zeal and enterprising spirit of Wedgewood brought to a high state of perfection our earthenware. The pen of Darwin has poetically illustrated the works of this enlightened man, who brought to bear upon a neglected branch of art, all that mineralogy and chemistry had unfolded, and who succeeded in forming establishments where we could compete with our continental neighbours. However much this branch of industry has succeeded, and however admirably the ingredients of which our pottery is formed may be mingled together, still are we wanting in those beautiful shapes, and harmonious forms, for which France is celebrated. How seldom do we see that classic taste and knowledge of the beautiful displayed in the ordinary utensils which our rivals in art so uniformly exhibit. Thinking only of the utility of the different articles in daily use, we seldom bestow upon their external appearance that laborious attention which we give to other subjects. We seem to think it a matter of little moment whether a cream-jug or a tea-pot are of beautiful workmanship and tastefully formed. We have no objection to see them well gilded, ornamented with variegated colours, or painted with floral decorations, but we are decidedly heedless as to its form; we care not whether it has a resemblance to some classic vase, whether its parts are in harmonious keeping, and that its dimensions have been carefully and accurately planned. In Sèvres, however, the mathematician has given his calculation, the lover of antiquity his model, and the painter his sketch, before the work is undertaken; and the result, even in articles of daily use, is beauty of form, and happy adaptation of parts.

In the exposition this year was placed a piece of furniture called Jardinière de Salon. It was devised, and entirely executed by Hyacinth Regnier. It is intended for the reception of flowers, having an hexagonal slab, supported on six feet. Nothing could equal the beauty of this piece of porcelain, which struck every one, as much from the extreme simplicity of its form, as from its harmonious keeping. Portraits of Theophrastus, of Varro, of Virgil, of Tournefort, adorned different parts; their colours of extreme richness, but without gaudiness. A Chinese cabinet, the composition of Leon Feuchere, was universally admired. Several landscapes, after paintings in oil by Borget, adorned it. The crowds which gathered around

the different articles of vertu, showed how much better a Parisian public appreciates these labours than do the inhabitants of London, who seldom seem to understand or regard that which solely belongs to the fine arts. The apathy with which the exhibition in St. James's Street has been received, is a pretty fair specimen of the perfect indifference of the great mass of our population to such subjects. For although the hall in which so many beautiful specimens of what may be done for the Houses of Parliament, has for a long time been opened to the general inspection, few visitors have availed themselves of the opportunity which was presented; and they seem to pass by, with listless indifference, objects which would have elicited from Parisians exclamations of admiration and approbation. The decoration of china is also better understood, or at least better and more largely practised in Paris. A number of artists are constantly employed who obtain the highest excellence in this beautiful branch of industry. Some of the porcelains ornamented by ladies, have been especially the rage in Paris. A copy of Raphael's Vierge au Voile, executed by Madame Jacotot, is amongst these.

EXHIBITION OF THE ROYAL BOTANIC SOCIETY.

The second exhibition for the present season took place in their garden in the Regent's Park, on Tuesday, June 4th. The extreme dryness of the weather, accompanied with bright sunshine and intense light, combined to render the test a severe one to the florist. Exposed to such a state of things, the more exquisitely delicate tints of colour, which in many cases constitute the chief beauty of the plants, which are cultivated with such consummate skill and attention, and displayed at these exhibitions, require in such cases the greatest possible care and lengthened experience to preserve the plants in bloom. Notwithstanding these adverse circumstances, the vast and capacious tents were found too small to contain the collections of plants which were brought together on the occasion in question. An additional tent of considerable magnitude was therefore erected, and numerous temporary stages were to be seen as having been fixed up on the morning of the day of exhibition. Indeed, nothing could exceed the extent and beauty of the flowers. The pelargoniums, the roses in pots, the heaths, air plants, calceolarias, fuchsias, pansies, pinks, cinerarias, cut roses, azaleas, &c., besides the large collections of miscellaneous plants, formed altogether a scene of floral beauty perhaps never equalled, and certainly never surpassed. The fineness of the weather, both on the day of the

show and for some time previous, contributed to bring together the large assemblage of persons who visited the garden, consisting of the principal aristocracy, foreigners, and persons of distinction.

Some idea of the magnificent display of plants may be formed, from the subjoined summary of the exhibition. There were present three miscellaneous collections of 40 plants each, five of 20 plants each, and four of 10 plants each; three collections of 6 tall cacti; four collections of 12 fuchsias; nine collections of 12 pelargoniums; three collections of 8 calceolarias; three collections of cut roses; twelve stands of 36 pansies; three collections of 20 roses in pots, and one of 10 roses in pots; eight collections of 15 Cape heaths; five collections of 6 Cape heaths; three collections of 15 orchidaceous plants, and two of 6 ditto; together with numerous minor collections, and a considerable number of specimen plants and seedlings.

The miscellaneous collections contained many splendid plants. In Mr. Barnes's collection of 40 plants, which received the highest premium, we may mention the following, which excited particular notice:—a splendid Ixora coccinea, with 30 clusters of its bright vermilion flowers; Aphelexis humilis, and Phœnocoma prolifera, having numberless gay rosy coloured "everlasting" flowers; and Polygala cordifolia, exceedingly well grown, and exhibiting a profusion of rosy purple bird-like flowers. To Mr. Hunt, of Bromley, who obtained the first prize at the former show, was now awarded the second: among his plants were Clerodendron squamatum, in fine health and bloom; Chorozema cordata, var. macrophylla, an extraordinary specimen of large size, free growth, and abundant bloom; Gompholobium polymorphum, an extremely delicate and difficult plant to cultivate, but in this case in complete vigour and profuse bloom, trained over a half-globular trellis. The third prize was awarded to Mr. Green, of Cheam, who had plants of Acrophyllum venosum, rather a new plant at exhibitions; a fine plant of the curious and interesting Erica elegans, and an exceedingly well grown plant of Lachnæa purpurea.

The collections of 20 plants also contained many remarkable plants; we noticed particularly the following:—from Mr. Stowe, of Bayfordbury, Kennedya longeracemosa, densely flowered; and Swainsonia galegifolia, an old plant, well grown; Mr. Attlee, of Lambeth, had an excellent Baronia denticulata; with a good Ixora coccinea, and several fine Ericas. Mr. Fraser, of Lea Bridge Road, had Hibbertia Cunninghami, a dwarf trailing plant, covered with bright yellow flowers; Pelargonium tricolor, an old and beautiful plant, well bloomed; Pimelia decussata, also old and well grown; and Euthales macrophylla, with thousands of deep yellow flowers, in a dense mass. Mr. Pawley,

of Bromley, showed a fine Gesnera reflexa, and a good plant of Gesnera bulbosa; Ixora coccinea, and Erica vestita alba in this collection were very good.

Mr. May's collection of ten plants was splendid: we can only name the following as being extraordinary; Leschenaultia formosa, Erica vestita alba, and E. depressa (nana). Mr. Bruce, of Tooting, had an extremely fine Pimelia spectabilis; and beautiful plants of Leschenaultia biloba, and Aphelexis humilis. From Mr. Clarke, of Muswell Hill, was a perfect Polygala cordifolia.

Among the specimen plants, Messrs. Veitch, of Exeter, were most successful, with a large, well-bloomed Erica depressa; equal in beauty and cultivation, with this, was Ixora coccinea, from Mr. Barnes, a most splendid specimen, with 40 heads of flower. Mr. Hunt received a prize for a large Boronia serrulata; as did Mr. Dawson, of Brixton, for Erica Massonii. The following were also rewarded. Mr. Hunt's Pimelia spectabilis, for being well grown; Messrs. Veitch's Hindsia violacea, and Centrosema coccinea, for rarity; Messrs. Henderson's Pitcairnea punicea, for rarity; Mr. Bruce's Pentas carnea; and Mr. Barnes's Blandfordia Sp. Gesnera tubiflora, though not in a state to receive a prize, was exhibited by Mr. Jackson, of Kingston, and also by Messrs. Henderson.

The best varieties of Fuchsia exhibited in the collections from Mr. Catleugh, of Chelsea, Mr. Cole, of Blackheath, and Mr. Gaines, of Battersea, were, F. Exoniensis, Eppsii, Majestica, Brockmanni, and Smith's Victoria. Cinerarias were not very fine. Mr. Taylor's obtained the first prize. Two seedlings of some merit, were also exhibited, one of which, named Eclipse, a dark crimson variety, obtained a prize.

The Pelargoniums were in fine condition: Mr. Cock, of Chiswick; Mr. Staines, of Lisson Grove; Mr. Gaines, and Mr. Catleugh, exhibited plants in the smaller sized pots. Mr. Parker, of Roehampton; Mr. Bell, of Chelsea; Mr. Gaines, and Mr. Catleugh, were the competitors in the class for plants grown in larger sized pots. Mr. Gaines had a splendid specimen plant, named "Mabel," which was at least four feet in diameter, and densely flowered, having more than 100 fine trusses of bloom.

Seedling Pelargoniums were numerous, but there were none of particular merit. Mr. W. Somes, of Clewer, obtained prizes for "Orion" and "Miss Peel;" and Mr. Cock, of Chiswick, obtained a prize for "Hector." A scarlet pelargonium seedling, from Mr. Smith, of Dalston, named "Eclipse," was also rewarded. Among the seedling Calceolarias, but one was selected for a prize: "Guercino," from Mr. Standish, of Bagshot, a fine variety, with dark brown markings and blotches on yellow ground. Mr. Kinghorn's "Lady Ann Charteris," "Hannah," and "Duchess of Sutherland," were in the same style.

As on the previous occasion, the roses in pots were very fine.

Messrs. Lane and Son, of Berkhampstead; Messrs. Paul and Son, of Cheshunt; Alex. Rowland, Esq., of Lewisham; and Mr. Dobson, of Isleworth, were successful competitors. Messrs. Milne, of Little Norden; Rowland, of Lewisham; and Paul, of Cheshunt, obtained prizes for cut roses.

Mr. Ivery, of Betchworth, received prizes for two seedling greenhouse Azaleas, of good qualities, named "lateritia pulchra" and "formosa;" Mr. Gaines also obtained a prize for a seedling named "King of Saxony."

The Cacti were exceedingly gorgeous. Mr. Clarke, of Muswell Hill, obtained the first prize for six well grown plants, including Epiphyllum, Ackermanni major, with 50 expanded flowers; and Cereus Scottii, a novel species, full of bloom. The second prize was awarded to Mr. Green, of Cheam, whose collection included a very large Epiphyllum speciosum, covered with bloom; E. Ackermanni, with very large flowers; and several good seedlings. Mr. Upright's collection, to which an extra prize was assigned, contained a splendid specimen of Cereus speciosissimus, with more than 30 of its gorgeous flowers fully expanded.

In a collection of Achimenes, shown by Mr. Dobson, was an exceedingly well-grown A. grandiflora, which is one of the finest in the genus.

Mr. Barnes, of Bromley, obtained a prize for a collection of Clerodendrons, which were exceedingly healthy, and well-grown plants.

The Ericas were one of the most prominent features of the exhibition; besides being numerous, they were exceedingly healthy and well bloomed, so as to render it all but impossible to particularize any. Mr. May, of Beckenham, obtained the first prize for a collection of fifteen kinds. Mr. Brazier, of Isleworth, and Mr. Green, of Cheam, were also successful competitors among the amateurs; whilst among the nurserymen Mr. Pawley, of Bromley, Mr. Jackson, of Kingston, Mr. Fraser, of Leyton, Messrs. Fairbairn, of Clapham, and Mr. Dawson, of Brixton, were severally successful. Collections of six Cape heaths were less numerous: Mr. Hunt, of Bromley, Mr. Barnes, Mr. Bruce, of Tooting, and Joseph Wells, Esq., of Bromley, were contributors. The plants were somewhat smaller than in the larger collections, yet extremely well bloomed. There were some seedling heaths: Mr. Jackson, of Kingston, obtained a prize for a fine one, named E. Eassoniana, and Mr. Brazier, of Isleworth, had an extra prize assigned to a collection of hybrid Erica vestitas, which were considered to be particularly fine: some of the best and most striking were, E. (*v.*) alba superba, E. (*v.*) rosesceus, E. (*v.*) variabilis, E. (*v.*) carnea, E. (*v.*) rosea albida, E. (*v.*) purpurascens, and E. (*v.*) Albertiana.

Of the highly curious and interesting family of Orchidaceæ, a goodly number were exhibited: Mr. Mylam, of Wandsworth,

exhibited a fine collection, which obtained the highest prize: it contained Phalænopsis amabile, the Indian butterfly plant, having large, dense, white flowers, resembling a moth, of exquisite beauty; Saccolabium guttatum, with pendant spikes of lovely pink and white flowers; Dendrobium moschatum, with orange and buff blossoms; Mormodes cernua, with extraordinary shaped, green spotted flowers; and Ærides odoratum, with spikes of delicate pink flowers, very sweet scented. G. F. Cox, Esq., of Stockwell, obtained the second prize: among his plants were Stanhopea quadricornis, S. insignis, and S. tigrina, all with grotesque-made flowers; Cattleya intermedia, and C. Mossiæa superba, both very handsome kinds. Mr. Redding, of Wimbledon, had a collection containing Oncidium ampliatum, Cyrtochilum maculatum, and Vanda Roxburghii.

Among the collection of six orchidaceous plants, were many specimens of considerable beauty; collections were contributed by Messrs. Barnes and Hunt, of Bromley.

Two plants among the specimen orchidaceous plants, deserve especial notice. That to which the first prize was awarded, was a splendid Barkeria spectabilis, exhibited by Mr. Brewster, of Cheltenham; it is scarcely possible to describe the delicacy and beauty of this, as yet rare plant: its flowers are of a soft, rosy pink hue, with the lip or lower segment considerably lighter, and marked with numerous spottings of a rich dark colour. The plant was exceedingly well cultivated, and had several spikes of flowers. The second prize was obtained by Mr. Robertson, of Ealing Pink, for a very superior plant of Stanhopea tigrina, which was only inferior to the preceding in being less rare in cultivation. It excited great admiration, the attention of every one being arrested by its grotesque, gaping, animal-looking, buff-coloured flowers, spotted and blotched with black.

Several collections of British Ferns were exhibited. Mr. Smith, of the Holme, Regent's Park, obtained the first prize for a very interesting collection; including plants of Hymenophyllum Tunbridgense, and Wilsonii, two of the beautiful and delicate filmy-ferns; Trichomanes brevisetum was also in this collection in fine character, as was also the reputed new British species, T. speciosum. These, together with the other plants forming the collection, were in excellent health. Another collection, from Mr. Taylor, of Streatham, contained some rare and interesting species, as Woodsia ilvensis, Asplenium marinum, &c.

Altogether, this exhibition may be regarded as one of the most superb which has ever taken place in or near the metropolis.

The number of rewards allotted by the judges on this occasion was 102.

DRAMATIC LITERATURE.

THE NEW COMEDY.

The public voice has decided against the comedy which won, from numerous competitors, the prize offered by Mr. Webster for the best prose comedy, illustrative of British manners and customs. The audience that thronged the theatre on the first representation were better judges than the committee, composed of men accustomed to the stage, of critics whose writings have influenced society, and of authors whose works have attained a well deserved celebrity. The manager, Mr. Webster, certainly merits well of all who love dramatic literature. He hazarded a large sum of money under any circumstances; he did not stand ostentatiously forward as a patron of his art, but naturally looked to the success of the play as a reward for his enterprise. The subject he selected was one that evinced on his part considerable judgment, and had a drama really illustrating the manners and customs of the times in which we live been the result, he would have conferred a benefit upon the present and upon future ages. Had there been such a representation as would have produced an effect upon the assembled spectators, we are persuaded that the general feeling would have been in its favour, for in spite of any prejudice that might exist, if a true mirror of the feelings, the ideas, and the manners of the day had been held up to the mind's eye, it would have been rapturously hailed, and have received the tribute which all are anxious in these days to pay to real merit. "Quid pro Quo, or a Day of Dupes," is a comedy of much merit, it has many good points, but if it be the best amongst many sent in for judgment, we must believe dramatic literature to be at the lowest ebb. Its claims to a place amongst our comedies must rest entirely upon happy points in its dialogue, and in these it abounds, but in the more essential points it is totally deficient. It has neither a well developed plot, nor any delineation of character which all are amused at, and fancy that they can find in society a resemblance. Our comedies boast amongst them some of the best descriptions of English manners at the different epochs in which they were written. The profligacy of the higher and middle classes, their gradual improvement, are as strongly marked in our theatrical literature as they are in the writings of the historian and the philosopher, and we can even trace the progress of our commercial prosperity in them: John Bull, the Poor Gentleman, the Cure for the Heart Ache, the Road to Ruin, as distinctively belong to the reign of George the Third, as do those plays which we now look upon as licentious and obsolete, to the reign of Charles the Second. Schlegel has well pointed out that the drama must be suited to the capacities and inclinations of the audience, and consequently to the national character in general, and the particular degree of civil-

ization. We had anticipated something in the form of a national comedy, which, whilst it held up to ridicule the foibles and failings to which society is liable, would also exhibit in their best features those honourable feelings, those pure morals, and agreeable manners which render it in unison with our own sentiments and ideas. We did not dare to hope to be dazzled by the bright coruscations of fancy, or to be borne in aërial flight upon those ethereal pinions which elevate us above this sublunary globe; we did not anticipate any of those tumultuous emotions, any of those ebullitions of mirth and joyousness which seem scarcely now to be considered legitimate, but we expected a refined gratification, and were most willing to think that a spontaneous homage would be called forth by the delineator of those chequered scenes of human existence which the stage so beautifully places before us.

A plot can scarcely be traced in this comedy. There is no leading passion, no tale to be developed. A succession of clever scenes follow upon each other, which have certain links, but which have no leading features to display. The simplest story, the most artless chain of circumstances, is better than a number of characters assembled together, we scarcely know why, who seem almost to have an existence independent of each other, and who might as well be left out as unnecessary to the whole narration. The author has not painted sketches from the different grades of society; she has selected an isolated class, of whose existence we are scarcely aware, but from novels penned by fashionable ladies, and from an occasional exhibition of profligacy before our legal tribunals. That there is an unfeeling, mercenary portion of elevated society, whose time is passed in following the dictates of their own foolish caprice, whose paltry ambition it is to collect, by unworthiest means, the dross that allures; who sacrifice the happiness of their children by unholy and heartless marriages, we believe; but these are the blots upon our social system, which are neither to be eradicated by satire, nor altered by exposure; and most decidedly they are unknown to the great mass of the people, who therefore are not amused by their exhibition, nor instructed by their failures and disappointments. The morals and the manners of the day are, in a great measure, formed by public opinion; there is much to be admired, much to be deprecated. Virtues, when exaggerated, become vices; generosity verges upon profusion, economy upon avarice; the uses of the drama are to exalt the one, to point out the miseries consequent upon the other; and this is to be done by showing the impressions they make upon the mind, when they are held up in the colours in which men see them, when they are moulded into forms which gain attention, because all participate in their apparent truth. To present a vivid picture of the feelings and ultimate happiness of virtue, in a series of well constructed and artfully

connected scenes which fascinate the attention, has been considered the legitimate aim of the drama, and with these may be interwoven the expressions which are displayed by the different grades of intellect under similar circumstances, and hence the delineation of characters, even untrue to nature, become sources of pleasure, a poetical exaggeration of that which passes around us, rendering the features of life, under its most ordinary form, somewhat more striking, is that which more generally pleases. The endless variety which human life and character presents in this country, ought to have furnished the skilful hand with all the necessary elements for a well constructed play; the limitation to so narrow a circle as that which the author has chosen, was most unwise, and certainly ill calculated to awaken the emotions, the sympathy, or even the mirth of a promiscuous audience. The reader of novels who graced the boxes might be enabled to comprehend the ideas which flowed forth, and might follow them with a greedy ear, but to the quiet citizen in the pit, there was nothing intelligible, save two or three smart allusions to the political events which the newspapers instructed him were going forward. To the gods of the gallery, excepting certain of the rainbow hue, there could be nothing agreeable. Instead of being witnesses of the intrigues of an ambitious lord, and a would-be member of parliament, with their servants participators in their vices and extravagances, they would have preferred some of those pictures which they know resemble something that they have actually seen, or fancy exist, and their boisterous expression of gratification is often more to be prized, than the approbation of the more artificial members of the community.

It may be said that one of the most popular comedies in the English language illustrates solely fashionable life, and that the School for Scandal has its characters from amidst that heartless class, whose morals and whose ideas are so little worthy delineation, but then each individual has its strong characteristic fully displayed, and is dealt with ultimately according to his merits. Careless profusion, hypocrisy, female thoughtlessness, uxoriousness, all are painted in glowing colours; virtue and vice are anatomized, their varied effects exhibited, and amid the scandal and the heartlessness of the personages who flit before us, there are moral truths constantly drawn forth which, whatever may be the capacities or the habits of the most miscellaneous audience, come home to the heart of every man. It is not our intention to analyze the plot, such as it is, of the drama before us; it is neither well conceived nor artistically treated; it might, however, pass favourably amongst the commonplace dramas of the day; but if we are to regard it as a specimen of the talent for theatrical writing which now exists, we must pronounce our honest opinion that such a production is unworthy the rank to which it aspires. We will not, however,

further discuss the subject; Mrs. Gore, to whom the comedy is attributed, possesses great literary talent, and has done much for the domain of the imagination, and had this play been simply brought forward as an ordinary production, we should have passed it by with the ordinary form of critical remark, but as the selected proof of the present state of dramatic authorship, we must declare that we had little idea of the debased state to which that branch of the fine arts had fallen, and that we regret that we have not been furnished with a specimen of what Young England is capable of producing more to our approval.

ITALIAN OPERA.

Costa, so long and so advantageously known to the English public as the Musical Director at the Opera House, produced for his benefit a new opera seria, entitled Don Carlos. This name is so associated with Schiller, that we have immediately floating before our vision long and tedious harangues, unimpassioned sentiment and argumentative philosophy, very delightful to the lover of German literature and German ideas, but totally at variance with the sensations which are awakened by melody, and the delicious thrills of well arranged harmony. We must, however, at all times remember the recommendation of Chesterfield, when we have paid our money at the doors of the Opera, to yield to our senses, and not to exact any thing from reason. Sufficient for the libretto of an opera has always been an outline of a plot, with a sufficient number of characters to introduce the required number of solos, duets and choruses. Indeed, in modern days, there is as regular a mechanical method of distributing the proper materials in their due positions as there is of arranging the type in printing.

Costa has shown considerable skill throughout his composition; and if we now and then fancy we recognise the traces of a friend once familiar to the ear, we have every reason to award him the praise of originality, and of much feeling of what is beautiful and striking, in many of the passages which impart pleasurable emotions.

The first scene is placed in a Carthusian monastery. Don Carlos is seen leaning upon a pillar, apparently listening with devotion to an anthem sung by the monks. The distant organ, pealing through the sacred edifice, produced its effect, which was altogether highly impressive; and had not there been some bad management in the scenic department, which somewhat marred the general effect, the mind would have been well prepared for a succession of beauties. The jealousy of Philip, the father of Carlos, is strongly excited against him, from the belief that he loves and is beloved by his mother-in-law, Isabella, and the death of the prince is decided upon in a council of grandees. He dies, however, by his own hand.

Upon these grounds is founded the plot, and with such materials Costa has produced an opera, which enables him to avail himself of our favourite Italian singers. A duet between Fornassari and Mario, an aria by Grisi, and one by Lablache, an attraction which cannot fail to excite the admiration of an audience, and a superb cavatina, with which Grisi concludes the opera, leaves exactly such an impression upon the audience as would be sure to secure a long successful career to the work of the artist. If not a first rate opera, it is one which will afford great pleasure to the lover of music.

MUSIC.

PRINCESS'S CONCERT ROOM, CASTLE STREET, OXFORD STREET.

We are glad to find that this elegant saloon is becoming available for those purposes to which it was destined. We wish that more attention had been paid to the means of ingress and egress of the company, even at the cost of some of the elaborate decorations; at present, the room when crowded is singularly deficient in this convenience. We felt this on the occasion of the concert given for the benefit of the Italian Gratuitous School, on the evening of the 20th. The part of the room near the orchestra was densely crowded, to the discomfort and interruption of that attention which the programme and performance demanded. The services of the following distinguished and accomplished artists were gratuitously afforded: Mesdames de Manara, and W. H. Seguin; Misses Lear, Turner, E. Turner, Duval, Ley, Parsons, Dolby, and S. Novello. Messrs. Ernst, Regondi, Piatti, Key, Marras, Brizzi, Seguin, Placci. Madame Bompiani and M. Benedict performed a duet on two pianofortes. Signor Pistrucci improvised, and orations, one of thanks in English, and the other in Italian, (Dante's description of the sufferings of Count Ugolino,) were delivered by two of the young *beneficiaires*. John Parry sang his Whittington, and Fair Rosamond, of course with applause, but we heard that he accepted some more substantial proofs of the value of his services. John Parry probably read what Ernst did for the Royal Society of Musicians the other day.

Madlle. Henrietta Roeckel, niece of the great Hummel, had her annual morning concert at this room on the 25th. She is a sweet winning young creature, whose gentleness and grace would disarm the most ferocious of the critical corps. She played worthily of her consanguinity, and sang (due allowance being made for her age) in a way that affords promise of approach to that perfection to which her godmother, La Sontag, now Countess Rossi, attained. She had the assistance of Staudigl, who *roared* Schubert's elegant Ungeduld to the satisfaction of an audience

far more numerous than judicious. Mr. Weiss sang a part in *comic* (we beg pardon) buffo duett, and a melancholy ballad, with the aspect and expression of a bandit. Has this young man no one to point out to him the absurdity of the truculence with which he invests all his performances. Miss Van Millingen has a sweet and touching voice, which accorded better with Benedict's ballad, "Scenes of my Youth," than with Donizetti's sprightlier strains. A Madlle. Mazel sang two ballads of her own composition, with great naïveté and expression. Her skill as a pianist is remarkable. Her touch is as playful and meaning-ful as that of John Parry, who, with Messrs. Hausmann on the violoncello, and Sachse on the trumpet, did much towards enlivening an otherwise heavy concert.

CONCERT ROOM OF HER MAJESTY'S THEATRE.—MADAME DULCKEN'S CONCERT.

As we had anticipated, this accomplished lady attracted round her the most brilliant assemblage of the season. It is a thing worthy of remark, that at Madame Dulcken's concert, and at one or two more, there is an entire absence of those odours of cleaned gloves and defunct cigars so fearfully prevalent among the bearded claqueurs and their fair companions, who, in spite of nominal half-guineas, throng this concert room. We have, however, to notice Madame Dulcken's concert, not to open a commission of inquiry as to how these odours (not of the *sweet* south, at least) find their way into these precincts. We have heard of concerts to which the public are invited to hear the compositions of two or three manufacturers of sounds; Madame Dulcken submitted to her audience the productions of no less than twenty-four, viz.:—Adam, Alary, Alvars, Auber, Bennett, Bellini, Cimarosa, Donizetti, Ernst, Handel, Marsthner, Mayseder, Mercadante, Meyerbeer, Moscheles, Offenbach, Orsini, Persiani, Poniatowski, Ricci, Rossini, Schubert, Thillon, Weber. Her coadjutors were Mesdames Grisi, Persiani, Dorus Gras, A. Shaw, Thillon, De Manara, and Miss Rainforth; Messrs. Mario, Corelli, Salvi, Brizzi, Fornasari, Lablache, père et fils, Staudigl, Mendelssohn, Ernst, Offenbach, Alvars, G. Cooke, Loder, Willy, Watts, Geffrie, Hill, Hausmann, Goodban, Howell, &c. Intermezzo, John Parry; and Conductor, M. Benedict. Madame Dulcken played three times with her wonted animation and exquisite taste; and, marvellous to relate, every one promised appeared in due season. The room was intensely crowded.

SOCIETY OF BRITISH MUSICIANS.

We were invited on Saturday, the 15th, to a *matine musicale* of the above society, at which Mendelssohn was to be present. The performances consisted of a quartett, by Cip. Potter; a glee, by J. Calkin; Davison's lamentable Lament, "Swifter

far than Summer Night,"—a trio for the pianoforte, violin and violoncello, by Horsley (C. E.); a *scena!!* from Rooke's Amilie, —a song, "Ah, non lasciami," by Macfarren, and a quintett for the pianoforte, two violins, viol, and violoncello, by F. Westrop. Each of these works has been noticed on its production. After their performance, the Doctor was invited to gratify the audience by an extemporaneous exhibition of his talents. He acceded; and sitting down, after a short and charming introduction, took a scherzo in Horsley's trio for his subject. This he worked in the most masterly and bewitching style, adding to it the best part of Macfarren's song, and concluding with an elaborate fugue upon both themes, to the rapture of all present.

MESSRS. MACFARREN AND DAVISON'S LAST CONCERT.

The public were collected in strong force to this concert by the hope of hearing Dr. Mendelssohn, Bartholdy in his own splendid trio, and young Joachim. The Doctor's performance imparted an entirely new character to portions of this work; more in earnest than Bennett, he gave a breadth to his imagination, which the other's playing fails to exhibit; while in other passages the author fell nothing short of the delicacy of his friend the Sybarite of the pianoforte. We allude to the difference between these two artists, because from their great approximation of sentiment we were led to attend to and compare their performances more closely than those of others, who have played this noble work. Young Joachim, in obedience to the Genius of Dulness, who seemed to have made these concerts the objects of her most particular care, played a dull tiresome fugue from one of Bach's Violin Studies. The playing was marvellously good, and the music miraculously flat. The remainder of the concert was made up of musical sandwiches, a slice of Macfarren between two of Davison's, or *vice versâ*, every thing being alike dumpish and dismal—gropings after astounding effects of modulation which astonish nobody. Parodies upon the oldest saws that ever were ground out by blind bards to the sounds of rebeck or monochord. And so far this season we take our leave of the "YOUNG ENGLAND" of Music.

MISCELLANEA.

THE WELLINGTON STATUE.

The death of Chantrey left us in apprehension that we should not see completed the work of art which had been commenced to adorn the neighbourhood of the New Exchange. We are, however, gratified to find, that not only is it a monu-

ment of the power of the great sculptor, but that it is an efficient representation of the state of art in this kingdom at the present moment. On looking from Cornhill we are immediately struck with the effect produced. Nothing can be more appropriate than the site that has been selected, backed as it is by the splendid buildings that have lately risen up, the general character of the figure of the hero and the charger on which he is placed is that of grandeur and magnificence. We are at once impressed with the most favourable idea; we do not require to go into detail, which is in itself a proof of its excellence; we do not stop to inquire into the costume, into the paraphernalia of the horse; we are satisfied with the general effect produced, and gaze with admiration upon it as a whole. We feel convinced that its proportions are correct, and that all is harmony that is connected with it. The statue itself is fourteen feet high from the feet of the horse to the head of the duke. The pedestal is complained of as being too plain to correspond with the florid architecture by which it is surrounded.

METEOROLOGY.

This science is about to receive considerable impetus from the researches which have been made under the immediate auspices of the Grand Duke of Tuscany in different parts of Italy.

THE CENTIGRADE THERMOMETER.

Amongst the autographs which are in the possession of the well known collector, M. Hombres de Fiornas, is a letter of Linnæus, in which he claims the first application of the centigrade scale to the thermometer. It is in the Latin language. "I was the first who determined to make the point of congelation zero, and the boiling point of the thermometer 100°, and this was for garden conservatories." Celsius has generally been received as the authority for the centigrade thermometer.

THE WOOL MOSAIC.

A novel exhibition has been opened in Regent Street, for the gratification of the public; it consists of a collection of specimens of tapestry, formed upon a new plan. Wool of different dyes, is so arranged as to present a perfect picture to the eye; it is effected without weaving, sewing, or any of the usual means. Adhesion is procured of the ends of the wool, by an invention which has been patented, and the surface is made to represent historical pictures, portraits, or any design. A variety of shading and a richness of colour may be presented, which far surpasses the most perfect tapestry, whilst the expense is infinitely less. All descriptions of furniture may thus be decorated, and boudoir carpets and rugs may be made in the highest

degree ornamental. The invention is German, and has been very favourably received on the Continent.

MUSEE LAMBOURG.

An artist of the name of Lambourg has brought from Saumur to Paris a singular collection of works, the result of forty years' unwearied industry, and has formed a museum which is now exciting great curiosity. It consists of a representation of a menagerie and of a botanic garden, formed entirely of glass, which is moulded into its different shapes whilst in a state of fusion. The imitation of the external covering of the animals, and the representations of vegetable life are perfect. He devoted nearly eight years to the construction of the tiger; its external characteristics are admirably shewn; the manner in which he imparts his colours has been the theme of much discussion amongst chemists, as he produces tints from metallic substances of a delicacy which has never before been witnessed.

THE DEATH OF DR. HOPE.—Chemistry has lost one of its ablest teachers. Professor Hope, who for nearly half a century filled the chair of chemistry, is no more. Although Dr. Hope made no brilliant discovery, nor exhibited any of that enthusiastic love for the science, which has made so many men eminent, he was a diligent and careful cultivator of all the branches that he taught. He was the teacher of many of those who have most distinguished themselves, and deservedly was respected by every one who knew how to appreciate good sense, straightforward rectitude, and honest judgment. His manners were strikingly elegant, almost too refined for a class of young medical students, his language pure, his information correct and well digested. He was uniformly successful in his experiments before his class, for he had most carefully and exactly rehearsed them before he attempted to display them, and his great nicety was generally the source of that correct exhibition of the effects arising from chemical charges, which generally produce such an effect upon the uninitiated. He may not have possessed the genius of a Davy or a Faraday, but he had the industry and the intelligence which render a man useful to society.

THE DEATH OF THOMAS CAMPBELL.—The delightful poet who taught us in exquisite language the Pleasures of Hope, has left the stage of that world he was so capable of adorning. He was born in 1777, he received an excellent education at the high school of Glasgow, of which, in after life, he was elected the rector. At twenty-two years of age he published his Pleasures of Hope, at a period when the memory of the wrongs of Poland was fresh, and every line was hailed with a rapture which never subsided. His Gertrude of Wyoming, and his Odes, will be admired as long as English literature shall be cultivated. His latter days were mostly spent in London.

Atmospheric Railway.—Sir John Macneill, the engineer of the Dublin and Drogheda Railway, doubts the efficiency of this contrivance in frosty weather. Mr. Herapath is still employed in an elaborate investigation of the project, and has shewn in his journal the enormous waste of power to carry out the principle. Mr. Manby, the secretary to the Institution of Civil Engineers, states that that body has not expressed its approbation of the project. An experimental railway on this plan is to be constructed at Vienna, and a company has been formed.

Proposed Embankment of the River Thames.—This project at the present moment occupies considerable attention, and a vast number of plans have been proposed. Many of them look beautiful on paper, are doubtless feasible, more especially if money be disregarded, but the present state of Westminster Bridge in consequence of what was effected at London Bridge, ought to serve as a beacon against innovations. Neither the bed of the river, nor its banks, can be acted upon without corresponding changes in some other part. Amongst those which we have seen, and which present to the eye an agreeable promise, is a plan by Mr. Thomas Page: of its adaptation we cannot, of course, pronounce any opinion.

Atmospheric Engine.—Mr. Samuel Heseltine, junior, has, after much laborious investigation, completed the construction of an engine, by which a mechanical force, capable of driving machinery, is produced from the dilatation and condensation of a volume of air or of gas, by transferring that volume of air or gas alternately from a heated to a cold medium, and back again from a cold to a heated medium. This atmospheric engine, if brought to perfection, will, of course, supersede the steam apparatus. It is at work at Bromley, and has excited considerable interest amongst those who have had the opportunity of witnessing its powers.

Bermuda Lighthouse.—Messrs. Bramah and Robinson are employed in casting an iron lighthouse, which is to be erected on Gibbs Hill, Bermuda. Its total height, from its base to the top of the lightning rod, will be 138 feet, and it will be 368 above the level of the sea. It is formed of 139 cast iron plates, and contains seven rooms, whose floors are also cast iron; it is of conical form, tapering from twenty-five feet at the base to fifteen feet at the top.

Safety Beacon for the Goodwin Sands.—In the Polytechnic Review will be found various descriptions of the safety beacon, the invention of James Walker, Esq.; it has been taken to its destination, and will be shortly erected. We trust that the experiment will be found successful.

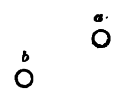
OBSERVATIONS IN SCIENCE.

BY JOHN JOSEPH LAKE.

I.—METEOROLOGICAL PHENOMENA, AT BELFAST, IN 1843.

ON the 12th July, at 15 minutes after 10, P.M., I saw, as it were, two moons nearly over the village Castlereagh. I at first thought it arose from refraction through the glass of the window, but found on examination that such was not the case. The false moon was very distinct, about half the brightness of the real one, and grew gradually paler. The phenomenon lasted about six minutes from the time I first saw it.

The relative position of the real and false moons are represented by *a* and *b*, *a* being the real and *b* the false one; the latter being to the eastward of the former. The sky was perfectly clear, and the weather hot.



The only cause I have been able to assign for this phenomenon is, that the false moon *b* was refracted through a denser medium than that through which the real moon was seen; and that this density was occasioned by vapours from a glen between two hills, nearly over which, though rather to the westward of it, the false moon appeared. Or the vapour may have ascended from the hills themselves, for during the present summer (1844) I have seen the hill on which Castlereagh is situated, and another adjoining, smoking so that I at first thought there was a fire. This occurred at sunset, on a fine evening, when there were few clouds over head. No smoke arose from the valleys, only from the top of the hills.

On the 17th November, I saw the right limb of a mist bow. The sky was perfectly clear and unclouded over head, and the mist, which was heavy, was visible from the ground upward, about 100 feet. The prismatic colours were very distinct. I observed a similar appearance about a month previously, more to the south, and an hour earlier.

I again saw this phenomenon on the 9th December, at 35 minutes after 9, A.M. On this occasion I had the satisfaction of witnessing its formation. It began to appear as a whitish mark in the mist, at the height of about 150 feet. The prismatic colours appeared in a few minutes, very faint at first, but gradually grew stronger, and the limb descended steadily with considerable rapidity to the ground. The bow appeared more to the north than on the former occasions. The morning was foggy, but there were no clouds, and the sun had been up an hour and a half before the bow appeared.

This would seem to be a permanent autumnal and winter mist or fog bow; produced by the reflection of the sun upon

the heavy mist which at those seasons rises from the low damp grounds through which the Lagan flows, near Belfast, and on which the town is built, and that it is visible whenever the upper regions of the atmosphere are sufficiently clear. I have not seen it in the spring and summer, though I have watched closely for it; and conclude, the drops of vapour at these seasons are not sufficiently large to admit of the refraction necessary to produce a bow.

II.—MAGNETIC EFFECTS OF THE ELECTRICITY OF THE EARTH.

It has been found that bars and other pieces of iron, on remaining a long time in one situation, have become magnetic; sometimes even when, from their softness, they were not capable of permanent magnetism. At the same time these bars have been observed to become harder. The former of these phenomena may be attributed to the effects of the electric currents of the earth, but the latter to some hitherto unascertained change in the properties of iron.

An oblong piece of iron, made red hot, and left to cool in the direction of the magnetic meridian, also becomes in some degree magnetic, acquiring this power whilst hot and soft, from the electric currents, and on hardening in cooling it retains it.

In drilling, filing, and hammering, iron frequently acquires a considerable degree of magnetism. This may be drawn partly from the earth, but it arises in a very considerable degree from the electric excitation produced during these processes.

Many other phenomena are caused by the electric currents of the earth. But the most remarkable, perhaps, is the magnetism induced or generated in the loadstone, which, as is well known, is an iron ore mixed with different ingredients.

A very natural question arises on this last instance. If the electric currents of the earth induce magnetism in some iron ores, why not in all? This is the reason—it is not under every circumstance that an electric current will induce magnetism in iron. But an electric shock through this metal always renders it in a greater or less degree magnetic; and as it is certain that there are electric currents and discharges in the earth[a], so the magnetism of the loadstone is developed by the discharge of the fluid through it, or by induction.

For magnetism is generated by induction; and when an electric shock takes place in the earth through any stratum, a shock or current is induced in all surrounding strata. To prove this, wind some copper wire round a cylinder of wood as a helix, preventing the different spires from touching by a thin interposing twine; cover this helix with calico; then wind a second wire in the same manner. To one of these wires attach a

[a] Polytechnic Review, May, 1844, p. 263; June, 1844, p. 18.

hollow helix from round a glass tube, introduce a steel needle into the tube, and make contact between the galvanic battery and the other or inducing wire. On removing the needle before the battery contact is broken, it will be found magnetized. When the battery contact is first made, then an unmagnetized needle introduced into the hollow helix, and lastly the battery contact broken, the needle is magnetized to an equal degree apparently with the first; but the poles are of the contrary kind. When an unmagnetized needle is put into the hollow helix, before the contact of the inducing wire with the battery, and remains there until the contact is broken, it exhibits little or no magnetism, the first effect being nearly neutralized by the second[*]. Notwithstanding, some magnetism remains, and to the operation of these and similar principles we may attribute the origin of the loadstone. For a shock passed through the inducing wire will produce the same results as a current.

III.—THE PREVENTION OF EARTHQUAKES.

When the electric origin of earthquakes first occurred to me, I thought it quite possible to prevent them, if a metallic or other good conducting communication could be effected through the temporary, or permanent, non-conducting strata, so that the electric currents might find a ready passage; I found, subsequently, that this idea had actually been carried into execution.

The Chevalier Vivenzio, at the latter end of the last century, being convinced that earthquakes were the result of electric discharges in the earth through bad or non-conducting media, and, probably, borrowing from the lightning conductor, proposed to fix metallic rods, terminating in a number of points like a brush, in the ground to as great depth as possible.

But a better method has been carried into execution. In Naples there is a pyramid erected before a church, under which is a deep well, with several mouths opening about the base. This was made that the water, being a conductor, might form a good electric communication between the strata through which the well is sunk, and thus, acting on the principle of a lightning conductor, draw off the fluid.

In the city of Udine, wells and other excavations have been made for the same purpose, and also great numbers in Nola, in the kingdom of Naples.

The success of the attempts at Naples and Udine does not appear; but at Nola it seems most unequivocal, for that city was never known to be damaged by earthquakes.

[*] Vide Experimental Researches in Electricity, by Michael Faraday, F.R.S., Phil. Trans. 1833, p. 125, for further illustration of the induction of electric currents.

THE METROPOLITAN BUILDINGS BILL.

Under this title has been brought before the House of Commons a series of new laws, which ought to be called a bill of pains and penalties, for the protection of London from further extension, and inflicting upon builders, and all those who have a mania for erecting houses, trouble, expense, and litigation. We suppose that an alarm has spread itself amongst her Majesty's advisers, similar to that which took possession of the Lord Mayor of London in the year 1579, immediately after the earthquake, which, though it lasted one minute only, shattered many houses and churches, and killed several people, and induced him to represent to the ministry of Queen Elizabeth, that the increase of London would tend to such an overflow of population, that there would be an excessive price of provisions and fuel, and consequently great danger from infection; the consequence of which was, a proclamation to forbid any new building of houses or tenements within three miles of the gates of the city, or upon any spot where no houses existed within the memory of man. Notwithstanding the present bill has extended the localities for the operation of a building act, and has even provided that her Majesty may in Council direct that its provisions may apply to any place within twelve miles of Charing Cross, yet such are the penalties for commission and omission, so severe are they, that we should imagine they were drawn up for the purpose of sorely annoying the vast legion of builders who are surrounding the old metropolis with houses sufficient to supply another generation.

The preamble is certainly good, and if the regulations had been simply made without introducing new offices, and without encumbering the builder with a vast mass of annoyance, the bill would have been hailed as necessary in the present state of the great city. No one can deny the necessity of extending the limits of the existing statutes, which were quite sufficient, with the introduction of a few clauses to amend the law; the improvement of the drainage, the securing a free access of air to every house, a proper width to the streets, situations for open squares for public walks, the prevention of deleterious or dangerous trades in manufactories, the improper uses of buildings, are subjects of paramount importance for slow and deliberate legislation, founded upon calm reflection and long experience. The act passed in 1677, immediately after the fire of London, for granting the corporation powers to open and enlarge the streets and lanes, for directing how the new houses were to be constructed, and for the regulation of builders, together with the orders passed by the Common Council, and which were confirmed and enforced by an order by his Majesty in Council,

were the basis upon which have been founded the different enactments which form the law of the land.

The gradual extension of the city led at various times to alterations, but at length parliament arrived at a satisfactory knowledge of what was actually demanded, and A.D. 14th Geo. III. cap. 78, an Act was passed for the farther and better regulation of buildings and party walls, and for more effectually preventing mischiefs from fire within the cities of London and Westminster, and within the bills of mortality, the parishes of St. Marylebone, Paddington, St. Pancras, St. Luke at Chelsea, in the county of Middlesex; and repealing former acts of parliament for the like purpose. This act was most skilfully, carefully, clearly, and ably drawn up, in a succinct manner, in 102 sections; it has stood the test of 70 years, and is now perfectly well understood by all builders, surveyors, and architects. From the length of time it has been the law of the land, every doubtful point has been decided and settled; it has worked well for the purpose it was intended; it has prevented the spreading of fire, with a very simple and not expensive superintendence of surveyors in the several districts to which the act has applied. It is true that the buildings have extended in nearly continuous lines beyond the limits before mentioned, and therefore it is expedient to extend the circle of the operation of that act, and to remedy some other unimportant matters, all of which might have been done by a very short bill; but such has been the rage for legislation and change on every subject of late years, that in this case also an entire new bill was brought before parliament in the session of last year, which was so obnoxious and penal in its clauses and restrictions, as to cause so much objection and opposition that it was then abandoned. This session another quite different bill on the same subject was brought in and read, entirely different in its clauses and arrangement; since which the bill has been printed "as amended by the Committee," and so completely altered, that it scarcely appears to be the same bill, and is of immense length.

It is so minute in its particulars, that scarcely any alteration can be made in a building without the superintendence of the district surveyor, and the liability of penalties; it interferes in every erection or building, great or small, and scarcely any thing can be done to a building without so many notices and forms, as to make the operation almost like the conducting of a lawsuit. For example—

"And forasmuch as, from time to time, occasion hath arisen and will hereafter arise to execute the following works in relation to adjoining buildings and premises, parted by the same party-wall or party-fence wall, but belonging to different owners, or occupied by different persons, or to buildings intermixed, belonging to different owners, or occupied by different persons; namely,—the reparation of the party-walls by which such pre-

mises shall be parted: the pulling down and rebuilding of such party-walls: the raising of such party-walls: the reparation of party-fence walls: the rebuilding of such party fence-walls: the raising of such party fence-walls: the pulling down of timber partitions which part buildings, the property of different owners, or occupied by different persons, and building in lieu thereof proper party-walls: the pulling down of buildings built over public ways, or having rooms or stories, the property of different persons, or occupied by different persons, lying intermixed, for the purpose of building proper party-walls or party-arches: and generally the performance of other necessary works incident to the connexion of such party-walls or party fence-walls with the premises adjoining: it is expedient to make provision, as well for facilitating the execution of such works by any such owner desirous to execute the same (who is herein denominated the 'building owner'); as for protecting the interests of the owner of the adjoining premises (who is herein denominated the 'adjoining owner'); now for that purpose, be it enacted, with regard to all premises parted by a party-wall or party fence-wall, or parted by timber partitions, and with regard to all intermixed properties not so parted, so far as relates to the execution of any such works by any owner of any such premises, that if the adjoining owner shall have consented thereto, or if, without such consent, the required notice of such work shall have been given by or on the part of the building owner to such adjoining owner, then, subject to such modification as shall be made by virtue of the provision in that behalf; and subject to the provision for supplying the want of consent of the owners; and subject moreover to the respective conditions hereby prescribed, with regard to such works respectively, as well as to the payment of the costs of such works, and to the sanction or to the award of the surveyors or of the official referees, as hereby prescribed in reference thereto, it shall be lawful for every such building owner and he is hereby authorized or required to execute such works.

"And be it enacted, with regard to such works, so far as relates to the notice thereof, that unless the adjoining owner consent thereto, it shall not be lawful for the 'building owner' to execute such works, until he have given notice thereof to such 'adjoining owner;' and every such notice, with regard to the pulling down, rebuilding or repairing of party-walls or party fence-walls, must be given one month, at the least, before the survey of the work is to be made, and four months, at the least, before the work is to be commenced; and every such notice, with regard to the pulling down and rebuilding intermixed walls and timber partitions, must be given four months, at the least, before such work is to be commenced; and every such notice must be in the form or to the effect of the notice (No. 8.) for that purpose contained in the Schedule of notices hereunto annexed.

"And be it enacted, with regard to every such work, so far as

relates to the modification thereof, in order to render it suitable to the premises of the adjoining owner or his tenant, that if the adjoining owner, at any time within two months after the receipt of the said notice from the building owner, give notice of his desire that any modification be made in the work so as to render it suitable to his premises, according to the form (No. 18.) in the schedule of notices, or to the like effect, then, within seven days after the receipt of such notice, it shall be the duty of the building owner, and he is hereby required, to signify his consent to, or dissent from, such modification or delay; and that if the building owner do not within such seven days signify his consent to such modification, then it shall be lawful for the adjoining owner, and he is hereby entitled, to require the building owner not to commence the work until the official referees shall have determined thereon; and that if within seven days thereafter application be made in writing to the official referees, according to the form (No. 19.) in the schedule of notices, or to the like effect, and notice thereof be given to the building owner, according to the other form (No. 20.), then, within ten days after such application, it shall be the duty of the official referees to signify their decision thereon, and it shall be the duty of the building owner not to commence the work till the decision of such official referees shall have been given; and that if, within the period of four months from the date of the first notice, such adjoining owner do not make any objection or any requisition in conformity with this enactment, then, subject to the provisions of this Act with regard to such works, it shall be lawful for the building owner, and he is hereby authorized to proceed to execute the same.

"And be it enacted, with regard to every such work, so far as relates to the modification thereof, in order to render it suitable to the premises or to the convenience of the adjoining owner or his tenant, that if the adjoining owner at any time withing two months after the receipt of the said notice from the building owner, give notice of his desire that the work be delayed, so as to cause it to be executed at a more seasonable or a more convenient time in reference to the business, or to the family or domestic arrangements of such adjoining owner or his tenants, according to the form (No. 18.) in the schedule of notices, or to the like effect; then, within seven days after the receipt of the notice thereof, it shall be the duty of the building owner, and he is hereby required to signify his consent to, or dissent from, such modification or delay; and that if the building owner do not within such seven days signify his consent to such modification or delay, then it shall be lawful for the adjoining owner, and he is hereby entitled, to require the building owner to delay the work until the official referees shall have determined thereon; and that if within seven days thereafter application be made in writing to the official referees, according

to the form (No. 19.) in the schedule of notices, or to the like effect, and notice thereof be given to the building owner, according to the other form (No. 20.), then within ten days after such application it shall be the duty of the official referees to signify their decision thereon, and it shall be the duty of the building owner to delay the same till the decision of such official referees shall have been given; and that if, within the period of four months from the date of the first notice, such adjoining owner do not make any objection or any requisition in conformity with this enactment, then, subject to the provisions of this act with regard to such works, it shall be lawful for the building owner and he is hereby authorized to proceed to execute the same."

In the present act there is only required a notice for pulling down old party-walls, party-arches, and partitions; and notice to district surveyor before commencement of works. In this new bill there are no less than twenty different forms of notices in the schedule. The penalties for omission or commission are numerous and severe, viz. in section 13, treble fees to district surveyor for want of notice, and also £20 penalty; and if work is suspended and then recommenced, £20 penalty for not giving fresh notice, &c. By section 15, a penalty of £500 *per day* if buildings of the first rate of the second class are used before being certified. By section 16, the use of buildings (subject to special supervision) before certified, incurs a penalty of £100 per day. Clause 19, even the *workman* doing any thing in or about a building contrary to the regulations, will be liable to a penalty of 50s., or to be sent to prison for a month. And there are also many other penalties and liabilities if the forms of the regulations of the bill are not strictly followed and observed. Instead of district surveyors only, there is also to be two official referees and a registrar, each with a salary of £1000 per annum, £1500 of which is yearly to be paid out of the county rates, and the balance out of the consolidated fund of Great Britain; but fees are also to be paid to such official referees and registrar, towards discharging their salaries. These official referees are to superintend the execution of the bill by the district surveyors; to superintend specially all buildings of the first rate, of the warehouse class, and the public building class; to act as arbitrators, and make awards in any differences under the bill; and subject to appeal to the commissioners of her Majesty's works and buildings, with a fearful expense of fees to be paid by the builder for the services of the district surveyors and official referees.

It appears by section 40, that the known rules under the present building act, of the person receiving the last improved rent being alone liable to the expense of rebuilding party walls, will no longer continue; but in lieu thereof, to be paid by part owners, in such proportions as may be awarded by the official

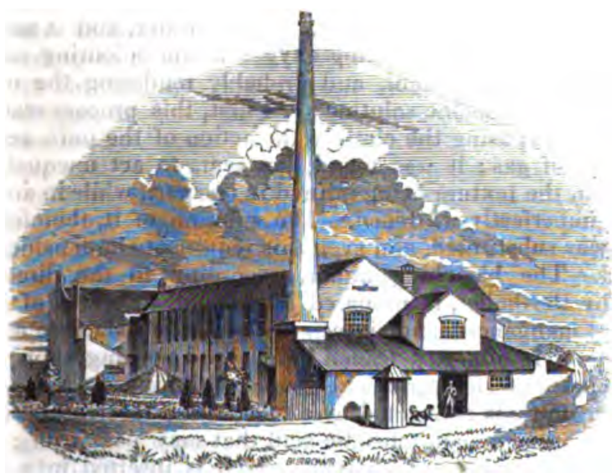
referees. So that owners or freeholders who have before been exempt under the building act, and who have from their lessees received a clear rent, may now by this bill have their incomes reduced greatly by such new liability. Section 51 is the only one as to drainage, the particulars of which are set forth in Schedule H, and leaves the drainage of buildings in nearly as imperfect a state as at present.

This bill has been nearly dormant until this late period of the session, but the new regulations are a serious matter to builders and owners of buildings within its operations, which may, by order of council, be extended to within twelve miles of Charing Cross.

It appears to be a proposed alteration in the law at present regulating the metropolitan buildings, which will cause much difficulty in builders, owners, and the public, to understand the forms and technicalities ; great expense, trouble, and vexation ; and in effect an entire new system in its operations, although the essential strength and security "against fire" will not be increased, as the sections of the thicknesses of the walls in the different rates of building are nearly the same in the present building act.

THE BLEACHING GROUNDS, HAMMERSMITH.

By Mr. Falkner.



The extensive Bleachfield, called "Spring Vale," carried on for a period of nearly twenty years, by the spirited proprietors, Messrs. A. McCulloch and Sons, is an object of no small interest, as you enter Hammersmith from London. It lies about a quarter of a mile to the north of the turnpike-gate, and its

handsome chimney may be seen at a considerable distance. It is eighty feet high, and was raised by Mr. Eatly, of Chelsea, in 1836. The whole premises, which are now the scene of much activity, were within the last twenty years a waste marsh, and afford another of the many instances to what great use enterprise and talent can turn the most apparently unproductive spots. The bleaching grounds and gardens, consisting of four acres surrounding the buildings, are inclosed by hedges. The business carried on is the bleaching all sorts of fabrics, and the dressing and calendering of muslins and calicos. The number of hands employed is generally between sixty and eighty, principally natives of Scotland. In the months of April and May, more than forty young Scotch women may be seen labouring bare-footed, with the industry so striking in the natives of that island, in and about this establishment. The substances upon which the bleacher is here required to exercise his art, are cotton, flax, hemp, wool and silk.

The art of bleaching consists, not merely in discharging the colour of the thread, but likewise in removing the colouring matter itself, as otherwise a sensible shade would be acquired. In the old method, this was attained by alternate exposure of the thread to the action of light, humidity, and atmospheric air, and to alkaline ley, the cloth being macerated in a solution of potash, exposed on the field to the air and sun, and frequently sprinkled with water; and these alternate practices being continued until the bleaching was complete.

In the new method, the action of the oxymuriatic acid is substituted for that of the light, air, and water, and it answers the same purpose by affording oxygen to the colouring matter, thus impairing the colour, and probably rendering the matter soluble in the alkaline solution. At first, this process was performed by exposing the cloth to the action of the pure acid in the state of gas; it was found, however, to act unequally on the cloth, the texture being injured in one part, while in another it was imperfectly whitened. The solution of it, therefore, in water was substituted, and even this requires to be considerably diluted. The bleaching liquor, according to the directions given by Berthollet, is prepared by putting six parts of black oxide of manganese, and sixteen of muriate of soda, into a glass or earthen retort, or a leaden bottle, and pouring upon them twelve parts of sulphuric acid diluted with nine of water. The retort or bottle is connected by a tube with a receiver, designed to retain any common muriatic acid that may pass over; from this vessel, another tube issues, which is inserted in a large wooden cask filled with water, the tube descends nearly to the bottom of the cask, so that the gas has to rise through the whole body of the water; at the same time, the absorption of it is promoted by the motion of a circular frame placed in the middle of the cask, and which can be turned round at the top.

The oxygenated acid is thus easily condensed. After the first disengagement of the gas has ceased, heat is applied to the retort by placing it in a sand bath, or if a leaden bottle be used, by placing it in a vessel of boiling water. It requires to be stronger for coarse than fine cloth, and for linen than for cotton: the average quantity stated by Berthollet is 100 quarts for every pound of muriate of soda that has been used.

AGRICULTURAL CHEMISTRY.

(Concluded from p. 18.)

To come to the important principle in question, upon which, however, the light is only beginning to dawn, and further investigation may tend to elucidate the chief nutritive principle of all soils is what was termed *humus* by Rozier, Parmentier, and Thaë, and *humin* by others. It is not to be denied that several distinguished chemists differ considerably in their views about this substance, and have accordingly imposed upon it several names; but they all nearly agree as to its being composed of carbon with oxygen and hydrogen, and they all agree in its being the main nutritive principle of rich soils and of manure. The explanations of the mode in which this substance is rendered available as the food of plants may without any great difficulty be reconciled, at least sufficiently so for the agricultural chemist, who ought not to bewilder himself with speculative theories.

According to Sprengel and Polydore Boullay, who are followed by De Candolle, humin procured from loamy soil, dunghill drainings, dung, or any similar source, is a dark brownish substance, somewhat similar to resinous bodies, and having, as Berzelius states, the acid property of reddening the blue colour of litmus test paper without being sour to the taste. In this form it can only be dissolved in water with difficulty, and in small quantities; but upon meeting with lime or ammonia an action commences, and new combinations are produced, which are readily dissolved in water, and may then consequently be taken up by the root fibres of plants in the form of sap, the problem which appeared so important to Kirwan to solve. Sir Humphrey Davy seems to have had a glimpse of these recent explanations, when he says, "In most of the black and brown vegetable moulds, the earths [meaning lime, clay, and flint] seem to be in combination with a peculiar extractive matter [humin] afforded during the decomposition of vegetables."

On the other hand, M. Raspail, a clever French physiologist and chemist, says that humin is not so simple and uniform a principle as has just been stated, but consists of oxygen and

hydrogen in the state of water, with which particles of carbon are mixed, along with accidental portions of acetic, oxalic, and other acids; and this, he says, accounts for its various degrees of dark colour and solubility, the carbon being black and insoluble till it be formed into carbonic acid; and the accidental acids account for its reddening litmus, while their small proportion renders them non-recognisable by taste. "The part," he says, "which humin has to act seems to be merely to absorb a sufficiency of oxygen to furnish the herbaceous part of plants with carbonic acid, which it is the office of the green substance to decompose for the nourishment of growing textures." Again: "The use of quick-lime in the preparation of composts, has no other object but to supply the place of potass, which would be too dear, for the purpose of disorganizing the textures intended to form the manure, and of disposing them, by carbonizing, for condensing and combining with the oxygen of the air, in order to furnish the part of the plant above ground with carbonic acid, which its leaves may elaborate."

Both explanations, it may be observed, agree in the fact that it is the introduction of carbon in the form of carbonic acid diffused in water into the plant, and therefore it is of less importance whether this be considered, with Sprengel and Berzelius, a peculiar principle extractable from soils or from manures, or a varying compound of carbon, water, and some acids with M. Raspail, even if we allow his single authority to weigh, as it ought not, against those of Berzelius, Sprengel, Bracconot, and P. Boullay, not to mention Klaproth, Vauquelin, Dobereiner, Chevreul, Thomson, and De Candolle.

Whether humin, then, be a peculiar uniform substance, or a variable compound substance, the constituents are nearly the same, and of great importance to be studied by the agricultural chemist, who will by that means be able, with considerable certainty, to ascertain the best manner of preparing his manures and his composts with the least waste of their nutritive properties, and of ascertaining the real qualities, as to richness or sterility, of the soils in his land.

With respect to manure, it is practically ascertained, in opposition to what was previously and erroneously laid down as science by agricultural chemists, that fresh dung is noxious to growing crops; and this is obviously caused by the acrid ammonia present in unfermented dung, which is driven off during the process of fermentation. When dung, therefore, is allowed to ferment previously to being spread on the land, the greater part of the superfluous ammonia is evolved, while another portion of it is not only rendered innoxious, but highly beneficial, by combining with humin, very soluble in water, and highly nutritious to growing plants.

On the same principles, the proper application of lime may be ascertained, a subject of great interest to the practical

farmer, who, from a want of acquaintance with agricultural chemistry, often applies lime to great detriment and loss, and may in the same way withhold it when it might be easily and cheaply obtained, and prove of great benefit. To mix lime in a compost heap, for example, with alternate layers of rich loamy earth, and with dung containing little fresh vegetable matter, as is not uncommonly done, is a very wasteful practice, productive of no benefit, for the lime being greedily absorbent of carbonic acid gas, which is always present in such cases, either in a free state, or as one of the chief constituents of humin, this gas is taken up, to the great impoverishment of the compost, while the carbonate of lime or chalk thus formed is insoluble, inert, and only useful as a pulverizer of the soil. The portion of the useful combinations of humin with lime, which under such circumstances may be formed, is too small to counterbalance the loss. It is only, therefore, when soils contain much peat earth, or undecomposed vegetable substances, that lime can prove very beneficial by hastening their decomposition. To dress rich loamy land with lime, as we have sometimes seen done, must be little better than madness, unless the land is foul, as shall be presently explained.

The next subject connected with agricultural chemistry, which we shall notice by way of illustration, is the recently discovered one of the excrementitious matters which all growing crops discharge into the soil, and which necessarily tend to deteriorate it from bearing successive crops of the same kind. Brugmans, Mirel, and more lately, M. Macaire, of Geneva, proved by experiment, that plants, like animals, do not appropriate and assimilate all the nourishment they take, but have the means of separating what is useful and rejecting what is useless, throwing off superfluous water and gases by their leaves and a sort of slime into the soil, such as may be seen adhering to the root fibres of hyacinths growing in water glasses. "M. de Candolle admits," says Macaire, "that every plant, in ejecting all the moisture that extends to the roots, cannot fail to eject also such particles as do not contribute to nourishment. Thus when the sap has been spread by circulation throughout the vegetable, elaborated and deprived of a great quantity of water by the leaves, and then redescending has furnished to the organs all the nourishment it contained, there must be a residue of particles which cannot assimilate with the vegetable, being improper for its nourishment. M. de Candolle asserts that these particles, after having traversed the whole system without alteration, return to the earth by the roots and thus render it less proper to sustain a second crop of the same family of vegetables, by accumulating soluble substances that cannot assimilate with it." It is, however, possible to imagine, that so far from injuring, these same excrements may furnish wholesome and abundant nourishment to other sorts of plants of different families.

The chemical consequences of these facts are found in connection with some of the most important processes of farming, and explain much that before their discovery was exceedingly mysterious and incomprehensible, giving rise to numerous theories, fanciful, useless, and often tending to mislead in practice. The chief farming processes affected by the discovery of the excrementitious discharges into the soil from growing crops are the rotation of crops, paring and burning, fallowing, irrigation, and draining.

On the principles advocated by De Candolle, and experimentally proved by Macaire, all the seeming anomalies hitherto difficult to be understood with respect to the rotation of crops are easily explicable. It has been known for ages to practical men, that good crops of the same kind could not be obtained from the same piece of ground, season after season; though this does not arise, as was formerly alleged, from the food in the soil being exhausted, since all plants feed nearly alike, but from the excrementitious slime, which acts upon the same sort of plants that produce it, as a slow poison. Thus the slime from a crop of wheat will greatly injure another crop of wheat, while it may do little harm to potatoes or beans; and the slime from beans will injure a second successive crop of beans, while it might do no injury to oats, barley, or clover.

Paring and burning, again, has been reprobated by most of the agricultural chemists, and more than one bill has passed the legislature to prohibit the practice, under penalties as high as ten pounds per acre, under the notion that it destroys the vegetable portion of the soil, which is the richest in nourishment for growing crops. That it does so to some extent there can be little doubt, and no farmer in his senses would pare and burn any rich, loamy land, unless he had good proof of its being greatly contaminated by the excrementitious matter of previous crops. The question in all cases would be, whether the freeing of the soil from this matter will compensate for the loss sustained in the process by the destruction of loam, a loss only replaced by a small quantity of ashes, which, indeed, are most commonly supposed to constitute the whole benefit of paring and burning. It is not a little remarkable, that Dr. Home approaches the very confines of the discovery of excrementitious discharges, when, in treating of paring and burning, he says, "farmers think it acts by dispelling a sour juice which land has contracted from lying long untilled; and it is found that the greater the quantity of roots, as happens in land which has been long untilled, the more benefit arises from the burning." That is, the herbage of old pastures has contaminated the soil, till it is rendered infertile, but its fertility can be restored by burning out or otherwise expelling "the sour juice" or excrementitious slime.

Fallowing, by which we mean summer fallowing, is another of the processes found to be practically useful, though it

is denounced by, we believe, all the chemical writers, from the Abbé Rozier to De Candolle, as similarly wasteful and destructive with paring and burning. The Earl of Dundonald says, that "by fallowing, not only one year's rent and labour are lost, but likewise the vegetable matter contained in the soil is thereby less fit to promote the growth of subsequent crops." His lordship was of opinion that green crops are more economical and beneficial to subsequent crops, because if ground receives benefit from being overshadowed, the same ground must receive injury by a direct contrary treatment. Sir H. Davy is still more inimical to fallowing. Mr. Brown, of Markle, again, whose practice is generally as excellent as his reasonings are faulty, considers fallowing as indispensable in wheat farms, though the only benefit he ascribes to it is the destruction of couch grass and other weeds. On strong clays, a correspondent of Sir John Sinclair says, "naked fallows every fourth year can alone enable the farmer to pay a high rent."

The chief benefit of fallowing is the exhalation of the excrementitious matter in the soil, by turning it frequently over and exposing it to the summer sunshine. Winter fallowing, that is, allowing land to lie rough ploughed during winter, can do little good, in consequence of the want of warmth, not less than the want of power in the sun's light, which is proved to have much effect in decomposing vegetable substances. Florists practically understand the process of fallowing, even better than farmers, being exceedingly careful in turning over their mixed soils, in order, as they not incorrectly express it, to sweeten them. Fallowing, in a word, is a slow method of paring and burning, almost as effectual as this process, and without destroying the richness of loam.

It is but right to mention here, that in the Quarterly Journal of Agriculture for September, 1834, a practical writer has brought forward a number of facts which he alleges to be contradictory to these views; but any unbiassed reader who chooses to examine these facts, will see that every one of them, without exception, tends most strongly to corroborate the preceding explanations. For instance, he tells us, that old pastures are improved by being broken up, that is, by opening the surface of the sward to permit the exhalation; that on newly broken up soil, "first crops are always luxuriant," and that "the succeeding crops get worse and worse;" that in a garden of light soil which has been ridged up for the winter, the centres of the ridges bear stronger plants than the intervals; and that "the top spit" of all land is "the richest and most suitable for plants." No stronger illustrations of the truth of our views could be adduced, than the facts of this objector, who is himself, besides being a practical man, a most imaginative and sturdy theorist, as practical writers (be it remarked) most usually

are, when they venture upon the difficult task of assigning reasons for their practice*, which is as much out of their line as practice is usually out of the line of men of science.

A no less effectual means of purifying land from excrementitious discharges is by the circulation of water in the important processes of draining and irrigation. Stagnant water is allowed by all writers, both practical and theoretical, to be one of the worst evils that affect land; meaning by stagnant water, moisture when found in such portions as to be distinguished from the soil which it moistens. But previous to the discovery of the excrementitious discharges of growing crops, the evil of stagnant moisture was not understood, and ascribed to all sorts of vague and unsatisfactory causes. "There is not," says Dr. Home, "a greater enemy to vegetation than too great moisture in the soil." Farmers express the effects of water by saying that it sours the ground. The natural effect of stagnating water I take to be, its putting an entire stop to the admission, and consequently to the influence of the air. "Water," says the Earl of Dundonald, "constitutes the chief food of plants. Certain degrees of cold prevent the absorption of water by vegetables. Water, during the continuance of such degrees of cold, is of no service; its presence at those times generally proves inimical." He adds, "the attention of the farmer should not be called away to other objects, such as the irrigation of meadows, until he has relieved his lands of the injurious surface water, and laid them sufficiently dry." His lordship, it appears from this, was not aware that wet lands are practically found to be as much benefited by irrigation as those which are dry, an effect which, previous to the discovery in question, could not be accounted for on any known principle.

Even a very recent writer of shrewdness and intelligence, Mr. Hayward, ascribes the effects of circulating water chiefly, if not altogether, to manure. "To shew," he says, "the beneficial effects of top-dressing, I took a field of pasture land of about twenty acres, a strong yellow or foxy clay. It lay on the side of a hill, and was very wet and poachy, particularly during winter; had been generally cut for hay, although it seldom produced more than three-fourths of a load per acre, and this not until the end of July. I drained it, by cutting a ditch at the upper side, deep enough to get below the stratum of clay, which in some places was upwards of five feet, turning the water down the sides, and gave it a top dressing of scavenger's manure, the cleansing of the town streets. The year after, it produced me a load and a half per acre in the middle of June, and a second crop of three-fourths of a load the beginning of September; and this it continued to do, vary-

* See Quarterly Journal of Agriculture for June, 1834, pp. 46, 47, 53; by Mr. Hawkins.

ing a little, more or less, according only as the seasons were wet or dry." Now it is very evident that the top-dressing was nothing in comparison to the draining, by which the accumulated excrementitious matter was carried out of the land with the previously stagnant water which held it in solution.

It must be obvious, from the views already stated, that the proper irrigation of any land must be very beneficial; but this can only be done when it is covered with a sward of grass; for in the case of ploughed land, the circulating water would carry with it a portion of the loam so indispensable for the nourishment of growing crops.

Amongst the strongest proofs of the effects we have attributed to irrigation, is that already mentioned of the process being beneficial to wet soils. Another very striking one, and altogether at variance with the common opinion, is that the water employed in irrigation, in order to be useful, must be pure and not loaded with mud and other feculence, it being practically ascertained that muddy water, such, for instance as that of rivers during floods, and more particularly what has been previously used in irrigation, injures more than it improves land over which it may be made to float. This is very well known in the instance of what is termed warping on the Humber, where the occurrence of a land flood spoils the warp. The instance of the fertilizing properties of the inundation of the Nile, which may be alleged, in opposition to these views, to be invariably ascribed to the mud deposited by the waters, we do not profess to be competent to explain, from not being sufficiently acquainted with the facts. In the case of old mossy permanent pasture, irrigation would be certain to treble the value of the grass. The application of liquid manure from common sewers and the like, acts by supplying plant food, and forms no objection to our views.

It would be no less wrong, however, to ascribe all sterility to the existence of excrementitious discharges, than with the old lady, in Miss Edgeworth's "Patronage," to ascribe all diseases to eating strawberry ice. Among injurious substances in soils, iron, in some of its forms, is one of the most common, as was first discovered by Dr. Home, the father of agricultural chemistry. "I took," he says, "one pound of good rich mould and mixed it with a drachm of salt of steel, (copperas or sulphate of iron,) put it into a pot, and sowed some grains of barley in it in the beginning of May; some of them shot up about an inch, looked very ill coloured and sickly, and then died; while other grains in another pot, filled with the same earth, throve very well. If this poison," he adds, "can admit of a cure, I imagine it is only to be found in lime or marl, which will attract the acid from the iron, and make it, at least in a great measure, indissoluble in water."

This is an excellent illustration of the benefits derivable from

agricultural chemistry, of which Sir H. Davy gives a later example:—"A soil," he says, "of good apparent texture, from Lincolnshire, was put into my hands by Sir Joseph Banks, as remarkable for sterility. On examining it, I found that it contained sulphate of iron, and I offered the obvious remedy of top-dressing with lime, which converts the sulphate into a manure." That is, as we see Dr. Home has just said, the lime combines with the acid, forming sulphate of lime or gypsum, a well known manure, and the iron is rendered insoluble and thereby innoxious.

Having thus given a few illustrations from the agricultural chemistry of growing crops, such as appear to us very striking and highly worthy of the attention and study of farmers, we shall now very briefly notice a similar application of chemistry to the treatment of domestic animals; and we do so the more willingly, that recent discoveries are no less remarkable in this department than in the instances which have been above adduced.

It has long been known to chemists, that starch is the chief ingredient in all nutritive vegetables, but though it would not answer on that account to feed animals on pure starch, because it has not bulk enough to fill the stomach, yet there can be no question that the greater portion of the starch contained in vegetable aliment ought to be, if possible, extracted, and made available as nourishment. Corn, for example, potatoes, and other articles of food given to animals, contain various proportions of starch, which cannot be sufficiently developed without some artificial process besides what is effected by the mastication and digestion of animals.

According to the recent microscopical discoveries of M. Raspail, and chemical investigations of M. Biot, the grains of vegetable fecula, and even of starch itself, consist of an envelope, and a kernel termed dextrine, from its polarizing light towards the right, and that in this dextrine chiefly the power of nutrition is contained. The envelope of the dextrine therefore requires to be ruptured, in order to give the animal stomach power over the whole nutriment, an effect which can only be produced by the influence of heat.

By the farmer it is seldom attended to, though of great importance, to prepare the food intended for working horses in such a manner as may allow them quickly to satisfy their hunger, that more intervals may be allotted for rest during the intervals afforded from labour. It has accordingly been proved to be advantageous to have all their food crushed in a mill, or broken by being passed through rollers. The Earl of Dundonald says, there is great reason to believe that the most judicious method of feeding horses or cattle with corn, is to give them malted instead of raw grain; and that barley boiled in sea water, or with a due proportion of sea salt, is a good sup-

per for hard working horses. But if this is considered of so much importance in the case of barley and other corn, of how much more benefit must it be to boil potatoes or carrots, in which the dextrine, while raw, is enveloped in a tough indigestible covering. We are not aware of any direct experiments on the comparative value of raw and boiled grain as given to horses or other cattle, but a series of very conclusive experiments were tried by M. Réaumur upon poultry. His details are much too voluminous to be given here, but the results in the instance of barley will prove the great saving that will accrue by giving it in a boiled state. Fowls, it is stated, which would have eaten two measures of dry barley in one day, ate but three measures of it when boiled; but ten measures of boiled are produced from four measures of dry barley, and therefore three measures of boiled are the equivalent of no more than six-fifths of a measure of dry barley; consequently the expense in dry barley is to that of the boiled as ten to six, or as five to three, or, in other words, two-fifths of the grain is saved by boiling it.

This extraordinary effect, however, was accounted for by M. Réaumur, wholly from the increase of bulk by boiling; while the discoveries of Raspail and Biot shew that the increase of bulk is owing to the evolution of the chemical principle dextrine, by the heat bursting its envelope.

In the disorders of cattle, some knowledge of chemistry is no less important. Animals which chew the cud, such as cows and sheep, are very apt to overgorge themselves with green raw herbage, and as the heat of the paunch, where this is in the first instance stored up, causes it to run into rapid fermentation, a great deal of gas, chiefly carbonic acid gas, is evolved. By this gas the paunch is distended, and should the fermentation continue, the stomach may be ruptured, and the animal may die. Many a valuable creature, says Mr. W. Hawkins, has perished in this way, whose life might have been saved, if the owner had been chemist enough to know what would stop the fermentation. The most effectual chemical agents for this purpose are stimulants, such as turpentine mixed with oil, or where this is not at hand, any sort of spirits, beer, wine, pepper, or mustard diffused in water, or even salt brine.

The preceding are a few, among numerous others, of the more remarkable instances which have occurred to us as illustrations of the importance to practical farmers of a knowledge of agricultural chemistry. At the same time, while we are of opinion that chemistry renders important benefits, and that it is calculated to confer still greater when its researches, enlightened by the progress of science, shall be more particularly directed to agriculture, we cannot help forewarning the farmers of the abuse which is made of the term "chemistry," and cautioning them not to place a blind confidence either in all works which

bear that name, or in all those who assume the title of chemists. Chemistry has its adepts and its empirics, as well as other sciences; and the farmer might easily ruin himself, and become the laughing-stock of his practical non-chemical neighbours, were he to regulate his operations, or ground their probable result, on theories devised in the closet, or on the minute analyses of the laboratory.

What is altogether novel, if at variance with long tried experience, even though it may appear very advantageous, ought not to be introduced without great circumspection and caution. Previous to any change of what exists,—to any alteration of what already prospers,—to any derangement of a course of operations under the idea of improving them, experience more extensive than a garden trial or a laboratory analysis ought to sanction the decided benefit of the projected innovation.

In default of such indispensable, salutary, and prudent precautions, which the agricultural theorist denounces as ignorance, prejudice, and obstinacy, the most prosperous farm may soon be seriously injured, and the farmer bankrupted. The agriculturist, when misled by theory, wanders for a time in doubt, darkness, and uncertainty; and after ruinous experiments, is glad to go back to his former empirical practice, and abide the taunts of those whom pseudo-science never taught to stray.

While, however, we may in some measure admire and commend the prudent circumspection of the farmer, who, almost inaccessible to new ideas, introduces no innovation till it has passed the ordeal of experience among his neighbours, we cannot hesitate to blame the obstinacy of him who rejects, without examining, all the improvements proposed to him, merely because such are innovations; for whoever does not keep pace with the progress of improvement, will most assuredly be soon left behind, as happened in a striking instance to the inventor of the steam-boat, Mr. Henry Bell. We have more than once seen his original boat, the Comet, working her tedious way up the Clyde at two or three knots an hour, while the newer boats, improved upon the original, shot far ahead, and ultimately left the ingenious inventor without passengers. In a similar way will the farmer be left behind, who, rejecting the ideas and improvements derived from agricultural chemistry, may be seduced by the specious plausibility of old Jethro Tull to give up manuring his land, and to depend wholly on repeated ploughings and horse-hoeings. These are, out of all question, excellent in their place, and indispensable in good farming; not because, as Tull alleged, they fit the particles of earth to be taken up by the roots of plants, which has been demonstrated impossible, but chiefly because they expose a greater portion of the soil to the influence of air and light, and consequently to the evaporation of the poisonous excrementitious matters

thrown into the soil by growing crops. By persisting in Tull's practice of ploughing and horse-hoeing without manure for a series of years, a farmer, unless his soil was previously very rich indeed, would be as certainly left without produce, as Mr. Bell's steam-boat was left without passengers.

The agriculturist is therefore placed between two rocks; on the one hand, that of blind credulity, which risks his capital in the introduction of hazardous innovations, and on the other, that of obstinate mistrust, which undermines the prosperity of his farm, by preventing the trial of methods suggested by science as capable of improving it, and of increasing his crops. Genuine wisdom, therefore, must obviously consist in taking a lively interest in all discoveries, and considering these with due attention, in making trial of every thing having the sanction of experience, or the testimony of practical farmers in its favour; but not to adopt as a method of operation any that has not undergone the test of a sufficiently extensive trial.

It is very evidently impossible for the agricultural chemist to unite in his laboratory all the elements of calculation which the practical farmer must take into account, before he decides on any subject. The implements to be used, the expense of labour, the interest of capital, the facilities of marketing, the peculiar taste of consumers, and the nature of the soil, are all data indispensable to be known, weighed, and calculated, and the practical farmer alone is able to procure sufficient information, in order to obtain results on which to ground his decisions and take his consequent measures.

"It may be asked," says Mr. W. Hawkins, "shall chemists and recluse philosophers teach farmers how to farm? Is it not supposed that men who have passed their whole lives in that pursuit understand it better than any body else? Most unquestionably they do. Sir Humphrey Davy would, most likely, have made a bad farmer. There are a thousand important considerations connected with farming, of which he was probably ignorant; but still he ascertained, in a manner clearer than had been done before, the principles which regulate the application of quick lime as a manure. And it does so happen, that many of our useful discoveries have been owing to men not connected in practice with the art to which their discoveries were applicable. Arkwright was a barber, Dollond was a silk-weaver. The compass, the chronometer, and the weather-glass, three of the greatest helps to navigation, were all discovered by landsmen."

Taking into consideration, therefore, the subject under review in its whole extent, there appear to be the two distinct objects of the scientific chemist and the practical farmer;—the chemist proposing, and the farmer judging and deciding. What appears most advantageous to the agricultural chemist may not be so to the practical farmer, because the chemist con-

sults nothing but science, while the farmer is acquainted with existing circumstances, compares the expense with the probable profit of the improvement, weighs the result of the previous and the proposed process, and grounds his decision on a multitude of facts and circumstances which the chemist can rarely know, and still more rarely is able to estimate. The agricultural chemist and the practical farmer, accordingly, have it in their power to render mutual assistance to each other; but in order to do so, it appears necessary for each to confine himself within the limits marked out by the nature of his respective knowledge and study. Any inversion of this order of things cannot fail to produce confusion, and lead to results ruinous to prosperity and discreditable to science[a].

ON THE EVIDENCE OF SCIENTIFIC MEN BEFORE LEGAL TRIBUNALS.

The opinions delivered by men of deep research in their own peculiar departments before legal tribunals are daily becoming the theme of wonder and ridicule to the public at large. Scarcely is there a trial involving a great question, that ought to be solved by those who have studied the points connected with it most deeply, than there is a collision of evidence, amidst the mockery and the sneers of the barristers, whose object is, of course, to win the cause and not to arrive at truth.

The conflicting testimony of medical men upon the subject of insanity, has tended to show that the judgment formed by persons of common sense, perfectly impartial, is quite as valuable and as much to be relied upon as the professional scrutiny of those who declare that they devote themselves to the examination and to the treatment of the insane. But medical evidence has unfortunately been long at a low ebb, and solicitors have every reason to believe that they can purchase it at graduated prices, and when we see the cases which have been subjects of the law courts, we cannot much be surprised at it. We find, for instance, such a trial as that which was brought by the widow of Mr. Kinnear, the banker, to recover £2000 from the Rock Assurance Company, in which six medical men, two of them physicians, after a careful examination of the dead body, pronounced upon the cause of death; while on the other side surgeons of eminence who had not that advantage, asserted that it must have been by poison, without assigning any other reason than that they were not satisfied with the opinions of the six other gentlemen.

We may possibly find some excuse for the difference of views upon subjects which are somewhat speculative, and that require

[a] Chaptal's Chimie appl. aux Artes, tom. i. Pref.

rather the exercise of the reasoning faculties than of the senses; but what are we to say of the practical chemists of the day? who should take nothing for granted, who ought to be guided solely by experiment, whose manipulations should prove the truth of their views. Yet the opinion is now tolerably prevalent that no reliance can be placed upon them, for we find their evidence upon matters of fact diametrically opposed to each other. We constantly observe in the daily press that upon a trial Professors A, B, C were for the plaintiff, and D, E, F were for the defendant, assuming as a fact that, that if subpœnaed by the plaintiff, D, E, F would have been his witnesses, and A, B, C those of the defendant, and that there had been a struggle not to arrive at truth, or to tell all that was known, but that the party who paid for the evidence was to have the benefit of every thing that could be found in his favour, and all that appeared prejudicial was to be carefully kept back. At the same time, we are prone to believe that not one of these Professors would be tempted by any sum to a deliberate falsehood; but they allow themselves to be biassed by their clients, they have taken up a one-sided opinion, and even should they in the progress of their inquiries find they laid hold of a wrong idea, they think they are bound in honour to go on in the path in which they have commenced their journey, and try to prove it to be the only one that leads to truth.

That carelessness—we must not call it ignorance—sometimes leads the public to undervalue the opinions of scientific chemists, we must concede. The late case at the Excise Office is an instructive one. We find two of the first chemists asserting that in a certain liquid there is not the trace of spirits, and we find Dr. Ure showing by analysis that actually three-fourths of the fluid is spirit. A case has just occurred which has involved some very interesting questions, and two of our most distinguished chemists were employed, Dr. Ure and Mr. Phillips, against each other; and whilst it was a singular sight to see two such eminent men brought into collision with each other, each anxious to show the superiority of his own views, it led rather to the conclusion that science was a marketable commodity, which might be brought to assist those who could afford to pay her handsomely.

Mr. Brookes, the proprietor of an estate at East Cowes, in the Isle of Wight, had embarked a large sum of money in an extensive speculation for the building of numerous villas. He considered himself fortunate in having found brick-clay upon the property, and commenced the manufacture of bricks upon a large scale. He baked them in clamps instead of in kilns, which latter are preferred by most brickmakers, because there is less waste, less fuel consumed, and the bricks are sooner burnt. A clamp is thus formed: its foundation is of dried bricks just made, upon which the bricks to be burnt are built up tier upon

tier; between each layer of bricks are two or three inches of cinders, from which the ashes have been sifted, and to which the technical term breeze is applied. The fire-place and its flues are constructed differently, according to the wish either to dry the bricks speedily or slowly. As the combustion goes forward, emanations and effluvia are, of course, given forth. Mr. Barwell, the proprietor of East Cowes Castle, who was the immediate neighbour of Mr. Brookes, found these vapours not only disagreeable to the senses, but laboured under the impression that they were highly destructive to the vegetation, and that they had most decidedly injured his plantations. He accordingly obtained an injunction from the Lord Chancellor against Mr. Brookes, the consequence of which was, the clamp was extinguished, and a most serious loss sustained.

Litigation having once commenced, it was carried on with most energetic decision by both parties. Chancery suits sprung from it, and, after various hearings on both sides, the Lord Chancellor referred it for arbitration to Mr. Swanstone, an eminent Chancery barrister.

Both parties seemed determined to carry on litigation regardless of expense. The proprietor of East Cowes Castle called witnesses to prove the injury his trees had sustained. As it has been a generally received opinion that the ordinary vapour from a brick clamp in action has no injurious effect, it was necessary to prove that there was some unusual circumstance attendant upon this clamp, and Professor Phillips gave evidence that the breeze employed by Mr. Brookes differed from that which is usually burnt, and that it contained sea salt; this becoming decomposed at a high temperature, gave forth hydrochloric acid, which produced the deleterious effect complained of.

This argument created considerable interest, and evidently much influenced the arbitrator. Dr. Ure, however, not only exposed the fallacy of the doctrine, but showed by actual experiment that the temperature was not sufficient for the evolution of the gas, but that from the clay ammonia was given out. The two learned chemists insisted upon these most contradictory opinions, and the arbitrator was sorely puzzled between them.

Botany was called in to lend its aid to solve the problem. Dr. Sigmond and Mr. Rogers gave it as their opinion that the trees which were declared to be destroyed were unhurt, and that their apparent unhealthy state was to be attributed to their exposure to the south-west blast, which has a striking influence on vegetation throughout the Isle of Wight. All evidence, however, was of little avail; the arbitrator could arrive at no decision after the big war of opinion of the chemists, he condemned each party to pay his own costs, and dismissed the case. Nearly five thousand pounds have been spent, both parties are dissatisfied, the chemists are laughed at, and had the

arbitrator gone down to the Isle of Wight on the day he gave his undecisive opinion, after six months' deliberation, he would have found the trees whose supposed decay had been the cause of the conflict, in full bloom and beauty, and the vegetation even more luxurious than it had been in former years.

SKETCHES OF CONSTANTINOPLE.

In sailing through the Straits of the Dardanelles, it is not until the promontory of the Golden Horn is doubled that all the beauties of Constantinople, Pera, the Bosphorus, and Scutari burst suddenly upon the view. The beauty of the scene almost rivals the attractions of fairy land, and the beautiful combinations presented by groves and bowers of orange trees, roses and jasmine, cypress and plane trees, surrounding the gilded and glittering minarets of the mosques, comprise altogether an apt realization of the splendours of enchantment. Curtains of roses hang from the trellis work and walls of the numerous villages, palaces, and habitations which occupy the whole line of shores on the Bosphorus, while the surface of the channel is covered by the graceful and light caïques which flit in all directions, and ply between the opposite shores of Europe and Asia. Ships arriving from the Archipelago sail close under the high walls of the seraglio garden, which is separated from the sea only by a narrow wharf, and so deep is the water, even close to the shore, that the main yard of large vessels scarcely clears the houses. Every portion of the two coasts is covered with gardens and villas, and those situated near the water have an arched entrance in the wall for the admission of caïques, by means of a small canal leading into the courtyard from the stream.

This form of light boat or canoe, called a caïque, is of the same description as the Venetian gondola, and glides equally softly and noiselessly through the waters. It is of a long and narrow shape, with a high prow, being painted black on the outside, with a stripe of bright red inside the stern, and is ornamented with carvings of flowers, foliage, and every variety of device, excepting the human figure, which is forbidden to be pourtrayed by the Mahommedans. The bottom of the caïque is covered with rich Persian carpets, and on these recline the persons to whom the boat belongs. It has no keel, and is rowed by paddles, long, and broad at the blade, sometimes by one or two, but more generally by three rowers. Some of the ministers of the court and other distinguished personages keep superb caïques, rowed by eight, ten, and even twelve men; but these boats, although very gorgeous, want the grace and

neatness which distinguish the smaller vessels. The dress of the boatmen is always of pure white, with a fez, or Turkish cap, just large enough to cover the crown of the head. At each stroke of the oar they utter a peculiar sort of note, or word, which regulates the time, and this is considered a necessary accomplishment of every boatman.

The walls of Constantinople are tripled on the landward side, having a ditch between each; and from the numerous fragments of granite and marble columns, many of them bearing inscriptions, everywhere mingled with the masonry, it is evident that the fortifications were built of the remnants of the ancient capital. They appear in some spots to be very ruinous, and in many places are thickly overgrown with ivy. Frowning over these, towards the sea, are the Seven Towers, a formidable state prison, which may be considered as the Bastile of the East. These clusters of forts were originally five in number, and were at first erected by the immediate successors of Constantine, to strengthen the fortifications at one angle of the wall which surrounded the city, but Theodosius had erected an arch flanked by two towers, to celebrate his victory over Maximus. The structure has since borne the name of the Seven Towers. Each tower is about 200 feet high, and of vast solidity, as the ruins of one of the most ancient, which fell in 1768, sufficiently testify. The walls which inclose them are double, and enormously thick, being built of immense blocks of solid stone; and, until the invention of gunpowder, were justly deemed impregnable. This once redoubtable fortress is, however, rapidly falling to decay, and a slender garrison are now its only occupants. If we are to believe the old traditions, although many of them are evidently pure exaggerations, the interior of these towers have been the scene of the most revolting barbarities. An aperture is entitled "the well of blood," which is said often to have overflowed with human gore; and a little court is pointed out within the precincts of the building, which is believed frequently to have contained a pyramid of human heads, so high that, standing on its summit, one might look over the walls, and behold the expanse of the sea of Marmora.

The palace is flanked towards the sea and in the direction of the Dardanelles with a very high wall, which continues for two or three miles, embracing in its inclosure the gardens of the seraglio and all the buildings belonging to it, and is lost finally in the south side of the city, which extends for miles in the above direction. This wall is surmounted with a parapet, and affords passages from the terraces for descending into a boat. Near the gate of the seraglio stands a large house, which is pointed out as the prison in which the rebellious pachas were wont to await the sentence issued against them by their imperial master; and here, too, was it carried into effect, whether it

was imprisonment, or if banishment, he was here shipped on board the vessel destined to carry him into exile; or if condemned to death, it was here the bowstring was applied. Hence this entrance is known by the appellation of the Pachas' Gate. A little further on is a small low door in the wall, scarcely high enough to admit an ordinary sized man. Through this narrow portal the slaves purchased for either the sultan or sultana are conveyed into the palace. It is through this opening also, if report speaks true, that the victims of jealousy and revenge are borne to meet their cruel fate, by being cast into the Bosphorus. In the palace of the Beschititasche there is a contrivance which may easily be imagined to serve the same purpose, for on raising a large square trapdoor in the floor, the sea is seen flowing deep and green beneath the pavement of the gallery. Imagination makes the unanswered inquiry, over how many victims has this barrier closed for ever?

The other buildings of note observable in sailing up the Bosphorus are the recently erected palace of the sultan, built on the Asiatic side of the channel. It consists of a long range of magnificent buildings, painted a rich colour between fawn and yellow, picked out with white, and profusely ornamented with gilding. The interior displays a singular mixture of European and oriental luxury. The old castle of the Janissaries, is the first fortress which the Turks possessed in Europe. It lies opposite to the beautiful valley of sweet waters of Asia, where the sultan has a kiosk, and hither, in summer, parties of pleasure make their favourite resort. This dale is named the Keathanè. In the castle of the Janissaries above mentioned, any one of that order who was condemned to die, was confined until the appointed hour, when he was led through a low archway opening on the sea and decapitated, his body being thrown into the sea. A long gun, standing by the side of the gate, was fired at the same moment, and gave notice of the execution of his sentence. The seraglio is inclosed in a double court, the first formed by the sultan's gardens, the inner gate, the grounds of the serai barracks, stables, and a portion of the outer wall. Within a niche on the left hand side of this entrance, the heads of rebellious pachas and other traitors are exhibited to the people; among the later are those of Ali Pacha, with his sons, Mouchar and Veli. Proceeding towards the entrance of the Bosphorus, stand the two castles of Europe and Asia. These two outward are called Anatole and Broumelly. They are studded with embrasures and loopholes, the walls of the defences being turreted with brick, and whitewashed. Other forts in the same style appear on each side, and look formidable enough with their long guns lying on the ground without carriages, and sweeping the surface of the water from shore to shore. Proceeding up the channel, which is not more than half a mile wide, are various buildings, government warehouses,

palaces, and public edifices for military or other establishments; the cliffs are high, but not very commanding, in some places composed of rock and rugged stones; on others are groves of wood and trees of different species, the most prominent of which, and spread in every direction, are the cypress, plane, and myrtle. Evergreens also cover innumerable walls and buildings, the high mountain ground forming terraces and plateaus on which are villas, country houses, and palaces, occasionally relieved by white spires, and minarets. Among the palaces there are many resembling Indian pavilions, but generally low, and of one story, hence they extend over a long line, and give an air of stateliness, which with the gardens and foliage which surround them have undoubtedly a most picturesque effect. A more close inspection of many of these erections is apt, from their general flimsiness, to render these scenes less pleasing, and on the whole, although Constantinople is on a first view striking from the novel features it presents to the western visitors, still it cannot be refuted that in the fine architectural features, monuments of art and magnificent structures, (excepting the great mosques,) Constantinople is more destitute than any other capital. One charming structure is undoubtedly the sultan's palace on the lower side of the bay; although it contains little furniture of a costly description, the usual display of oriental taste and magnificence being lavished on the baths, which are situated at a short distance from the main building, in a delightfully secluded spot, and are as luxurious and splendid as art can make them. The little valley in which this kiosk stands has been inclosed with walls, and it is possible to ride for five or six hours through the broad and stately alleys of this truly royal domain without passing twice over the same ground. In this retreat the late sultan Mahoud used to spend the most part of his time. Another noble structure, now unfortunately destroyed by fire, was the College of Pages. Its ruins stand on the north side of Pera, and in it were educated the pages of the sultan in various languages and accomplishments, from about the age of nine years till they were thought sufficiently instructed to attend to the duties of the palace. The Seraskier's Tower is another building of note, as from it a most perfect view of the whole capital and its vicinity is obtained. In the upper chamber of this is placed a party of men, who are stationed to give notice of fires, and on any appearance of an alarm they give warning by beating gongs and despatching messengers to all parts of the city.

The most interesting objects of research to the Christian visitor, and at the same time those most difficult to investigate, are the churches or mosques. Of these the largest and most elegant is that of Solimanie, which is the only religious edifice in Constantinople that can be seen by strangers without a firman or official permission. This mosque is extremely impressive from

its vast extent, sombre aspect, and unadorned simplicity. The interior is entirely destitute of ornaments and pictures, excepting innumerable lamps, which hang from the ceiling and dome, and two enormous torches of wax which are placed in niches, on the side towards Mecca; all else is plain and simple. The floor is thickly covered with carpeting, and the dome is supported by four vast pillars of granite polished by age. The outer court is surrounded by fine old plane trees, and the inner one, which is surrounded on three sides by cloisters, has several antique pillars, with an ornamented fountain in the centre of the yard. It does not, however, possess the renown of the mosque of St. Sophia, which is equally an object of veneration to Mussulman and Christian. In entering this most celebrated of the Turkish mosques, the *tout ensemble* of the interior is somewhat less imposing than the exterior induces to believe, and this is owing, in the greatest measure, to the disproportionate shallowness of the dome, the diameter of which is 115 while its height does not exceed 20 feet. There are in the interior a vast number of columns, of which eight, of porphyry, are from the temple dedicated to the sun by the Emperor Aurelian, and the same number of green marble from the temple of Ephesus, as well as many others, the spoils of various heathen temples. The floor of this mosque is covered with beautiful carpets, and the ornaments throughout are of great richness. In different quarters of the mosque are small raised pulpits, where dervishes or learned doctors sit explaining the Koran, and each has his own particular audience. The mosque being without pews or seats of any kind. seems so vast, that although it is really inferior in size to St. Peter's, or St. Paul's, in the visitor's eye it surpasses both. The verd-antique columns, the galleries, colonnades, stairs, and interior, are all of marble, the beauty of which exceeds all description. The roof is of a cemented mosaic, which as it decays is sold for relics. The Mosque of Sultan Achmet is situated in the Atmeidan, or ancient Hippodrome, and is worthy of notice on account of its beautiful court, which is shaded by fine old trees. To all these mosques are attached a greater or less number of minarets, or tall slender towers, in proportion to their extent, and these being all of a dazzling whiteness like the temples to which they belong, and surmounted by a gilded crescent, the appearance of so many brilliant objects in the clear sky, and the powerful sunshine of this clime, forms the most singular and attractive prospect which it is possible to conceive. The mosques of Solimanie, Achmet, and Bajazet, all differ in their space and interior, in their marble columns and ornamental appendages, but to have seen one is to have seen all, for it is only a repetition of what the perfection of art can accomplish. One singular feature of all the mosques is the magnitude of the wax candles which are kept burning around the altars and shrines; many of

these torches being several feet in height, when burning they produce a singular effect. The mosques of Sophia, Achmet, and Bajazet, are, together with the Seraglio, the most commanding edifices in the city, and as they tower above all the houses in the city are eminently conspicuous, St. Sophia being easily distinguished by its superior size, and by being flanked with a large minaret at each of its four corners, while its dome is surmounted by a crescent, or ball of gold. There are besides endless minarets scattered over the two heights, and forcing themselves, by their singularity of architecture, on the European visitor's attention. Their construction is that of tall cylindrical pillars, built of brick and whitewashed, having spiral tops, and a circular parapet forming a sort of capital from which the spires rise; the base is a common pedestal, either square or round. It is from the summits of the tallest minarets of the mosques that the Ezan, or cry of the muezzin, calls the faithful to prayer. The cry may be thus translated, "Come to prayer! There is only one God! and Mahomet is his prophet." This exhortation is uttered in a loud and piercing tone of voice, which being borne over the air produces a solemn and powerful effect. Just when the sun rises, the voice of the muezzin comes borne on the breeze, and almost ere the sound has died away, the morning gun from the camp responds to the echoes of those from the fleets, which are succeeded by the rattling of musketry from the marines, which mingles with the roll of drums and the blast of trumpets. The smoke soon begins to curl from the various roofs and to hover in thin masses over the cottages of the villages, and to shew that the great business of life has begun for another day. There are, however, few Mahommedans who commence their daily avocations without obeying the summons of the muezzin; and even if abroad, or distant from any house, they fall on their knees, turn their faces towards the holy city, and pay their orisons to the great prophet. Though the bell of the Christians tolling to prayer possesses over the soul a power whose influence is very generally acknowledged, yet the awful voice of the priest crying from the minaret is infinitely more solemn, and seems as if it proceeded from the Divinity itself. Report states that the voice of the muezzin has been employed for other purposes than those of devotion, and it was the command of Napoleon, when in Egypt, to watch the cry of the Ezan.

Near the slave-market stands the tomb of the Sultan Mahmoud. A blaze of gold and jewels surrounds the sarcophagus, and Cashmere shawls of the richest hue are thrown over it, while rich Turkish and Persian carpets surround it. The dome is of carved marble, as likewise are the sides and doors; and the fretted gilt windows give it the effect of inclosing the riches of Peru. Abdul Mesjid has placed on it, with his own hands, an inscription to the memory of his father, and relative to the taking of

Acre. The tables on which the beautiful illuminated Korans are placed round the tomb are of inlaid ivory and ebony; the large candelabras are of the brightest gold; the silver, ivory, gold inlaying, and mosaic, are of the most surpassing beauty; and, as a building, the whole erection is the most splendid in Constantinople. In the Sultana's mosque the bodies of some of the sultans, and many of the sultanas, lie in state. The coffins are deposited on a kind of throne, with four large wax tapers burning before them, and covered with the most splendid Cashmere shawls, the coffins of the women being distinguished by having no turban at the head. It is indeed a feature in Constantinople—the number of magnificent but extravagant monuments raised to the memory of her sultans. If one half the expenditure were laid out on works of public utility, the social position of the people would rank much more highly among the nations. The bazaars are a novel sight to an English visitor, there being a particular place allotted for the sale of every conceivable commodity. The chief of these are the arms bazaar, the bazaars for fish, for drugs, for fruit, for pipes, slippers, jewellery, silk, books and manuscripts, and lastly, the market for slaves. These grand bazaars adjoin that part of Constantinople called the Porte. They are large alleys, composed of ranges of shops or stalls, with other lines of street intersecting at all points, and forming a perfect labyrinth to the stranger. Before the series of shelves and wooden partitions which form each shop, a counter or table is placed, on which the owner of the wares sits cross-legged, with his goods packed all around him. The most entertaining and busy of all the bazaars, where each has its separate commodity, and where the dealers press every article upon your notice, is the arms bazaar. This is not only a mart for every species of weapon, but it forms many alleys and streets, where every article of luxury or use can be obtained, although, as its name imports, it is the principal purchasing place for arms, dresses, ornaments, horse-trappings and armour. There are here gathered together and exposed for sale the weapons, offensive and defensive, of every kingdom of the East and West: rifles, long guns, helmets, spears, bucklers, bows, battle-axes, swords, daggers, and poniards of every conceivable variety of form, are piled up in endless numbers. Many of these blades are of great value and beauty, and are of the rarest temper. The black blades of Khorassan are much valued, although entirely destitute of ornament, and forming a contrast to the Damascus sabres of exquisite workmanship with profuse arabesque ornaments, sheathed in a gold-embroidered velvet scabbard; the hilt covered with brilliants, and the blade inscribed from hilt to point with some verse from the Koran, in Arabic letters of gold. This bazaar is the great rendezvous of strangers who visit Stamboul. The cloistered passages exclude the rays of the sun, and are

cool and pleasant places to lounge in, except that the pavement is usually in a very dilapidated state. The merchants themselves present an interesting spectacle, each wearing the proper costume of his respective country, which, with the motley garb of the crowd incessantly passing to and fro, amuses the stranger's eye with a curious and almost infinite variety of dress and appearance. For the convenience of those who arrive periodically at Constantinople from the most distant parts of the empire, in caravans or large assemblages, there are large khans provided, which, being built entirely of stone, are fire-proof, and afford ample accommodation for the merchants, with their attendants and property. The fruit bazaar stands on the Lemon Skalese, and here are shops displaying the utmost variety of every kind of fruit, a large tray-full of which may be purchased for a few paras. Passing through this place to where wax-candles are sold, we next come to the pipe-stick bazaar. The pipe-sticks which constitute the chief commodity of this bazaar come from Persia, by Trebisond. They are formed from the cherry-tree, and are brought to Constantinople in pieces of about two feet long, and, after being set straight, are dressed with infinite care. They are united into sticks generally of five or six feet, though some are as long as ten or twelve feet; and the junction is so skilfully concealed with the bark, that in a well-made pipe it is impossible to discover it. When polished they are ready for sale, being left unbored until the merchant has found a purchaser. From thirty to one hundred piastres is the usual price demanded, but it differs according to the length, size, and fineness of the bark, and dark-coloured sticks are preferred to those which are lighter. Pipe-sticks are also made of rose-tree and other woods, but the favourite summer pipe is of jasmine, which is not so dear as the cherry, and is very light and flexible. They are cleaned by squeezing lemon-juice through them, which is also rubbed over the outside to render them cool. Another species of pipe is the narghilé, or water-pipe, which is a species of hookah, consisting of a glass bowl partly filled with water, a pipe-holder fitted into its taper neck, and a long flexible tube made of embossed leather and brass wire, through which the smoke is drawn. The bowls are manufactured of clay, in various forms; some being plain, others really elegant, with abundance of gilding and ornament. The amber of which the mouth-piece is made constitutes the great value of the Turkish pipe. Of the amber, there are two kinds; the white, creamy, or lemon-coloured amber is the most valuable, and a large mouth-piece of the purest is sometimes valued at fifty or sixty pounds sterling. The second or yellow sort, being the most common, is valued according to its freedom from flaws and spots; and a third variety is valueless, on account of its transparency. The amber is imported from Dantzic in lumps, and as there is considerable risk in the purchase and manufacture

of the crude article, it is excessively valued when it turns out well. The mouthpiece of the Turkish pipe, in addition to being formed of amber, is frequently adorned with precious stones, enamelling, or carving, according to the fancy or means of the purchaser. The tobacco smoked in the ordinary pipe is brought from the Crimea, Salonica, Latakia, Ormus, and other parts of the East. The Salonica tobacco is mild and excellent; that from Latakia, on the contrary, is strong and dark-coloured. The tobacco smoked in the narghilé is damped previously to being put into the bowl, and is of a different quality and cut, the best coming from Shiraz. Every Turk, indeed every inhabitant of Constantinople, carries about with him a bag of Cashmere or silk, in which he carries a supply of opium or tobacco, and one of the greatest luxuries of the Osmanli is to produce by its means a "kief," or state of placid intoxication.

The bath is another, and one of the chiefest luxuries of the Orientals, and on these are lavished the most costly and magnificent devices. In addition to the frequent ablutions enjoined by their religion, the enervating heat of their climate, and the habitual custom of continually wearing the same change of dress, make the Turks most attentive to this ceremony of bathing and cleaning, both for refreshment and from notions of duty. These baths consist of three heated rooms, the first having a temperature of about 80°, the second 100°, and the third about 120° or 130°. The bather being assisted to undress by the attendants, and being furnished with wooden clogs and covered with a linen robe, is conducted through the three rooms successively. The third bath-room is furnished with a low marble seat, on which the bather being seated he is furnished with pipes and coffee, and afterwards he undergoes the process of rubbing, squeezing, and twisting the body, for which the Turkish bath is so widely celebrated. The patient is next deluged with hot and cold water alternately, and having gradually returned to a moderate temperature, he again is offered pipes and coffee, and departs. The men bathe in the forenoons, as the women have the use of the establishments in the afternoons, and it is of course here that all the news and scandal of the town is circulated, marriages concluded, and their intrigues reciprocally detailed. Almost every quarter of Stamboul is furnished with its baths or hummums, and the houses of all rich Turks have likewise these luxuries. Fountains and jets of water are another species of convenience in which the Turks indulge. One of these of singular beauty is erected in the centre of the fish and vegetable market, which, from its vicinity to the arsenal, and from its being the landing-place for all pleasure boats coming from the neighbouring villages of the Bosphorus, is constantly occupied by a crowd of idlers. Nothing in such assemblages as these strikes the eye of the stranger more than the infinite variety of costume. The dresses of every nation in the world mingle with

each other and form the most picturesque and artistic groups. The Frank in his close-fitting raiment contrasts with the loose-robed Turk in his cloth cloak, silk gown, silk jacket, enormous trousers, yellow or red boots, and crescented turban, while Jews, Greeks, Armenians, Albanians, Persians, and Egyptians elbow each other in the crowded thoroughfares, and afford to the spectator a sprightly and ever changing scene. Among the Turks themselves the reforms of the late Sultan have caused a considerable variation of national costume. The prevailing dress is now a straight cut coat, which is always worn buttoned to the top; a fez or Turkish cap with a long tassel, and as all ranks, from the very highest to the lowest, are habited exactly alike, it is generally very difficult to distinguish the master from the commonest of his household, all wearing precisely the same style of dress, the same cut of mustachios, and all, in general, smoking the same pattern of pipes. The dress of the naval and military officers is a sort of frock coat, with the usual fez or cap. The sultan himself is generally habited in a very full cloth cloak, of a dark green colour, and clasped at the collar with a magnificent aigrette of diamonds. Under the mantle, on the breast of his coat, he usually wears the decoration of the crescent, also in diamonds, of most superb brilliancy, but, surpassing all in matchless size and beauty, are those jewels with which the hilt and sheath of his sword are decorated. In person the sultan is tall and sallow complexioned, his face long, with fine eyes and eyebrows, and he possesses a pleasing voice, with considerable facility in speaking both in Turkish and in French.

The Turks are still far from possessing an effective army, notwithstanding the pains taken by the late sultan to introduce European tactics. The Turks make excellent sailors, and when properly disciplined by officers of experience, will, without doubt, become of consequence. At Navarino, it is universally admitted that they behaved with the utmost intrepidity, but indeed it is one distinguishing characteristic of the nation to be brave. The cultivation of the soil is another point of serious consideration, in which Turkey may be said to be still in its infancy. No part of the world possesses the natural advantages of climate and soil in a more favoured degree; but these advantages are more than counterbalanced by the want of means of internal communication, and from want of encouragement of exports, and of the means of transport, the growth is neglected, and languishes in the country. Little more than is needed for the support of the vicinity is grown in many places where the soil would bring ample returns for the outlay of labour, slight too, as this is, in a land so fertile. The capital, however, is dependent for supplies of the first necessaries of life, on the imports of grain and other produce from Russia and the East. The continuance of peace, which at present

seems appreciated by all classes in Turkey, will enable the administration to turn their attention to these subjects, while the increased communication between the city of the East and the more polished nations of Europe, will pretty confidently tend to ameliorate the condition of the suffering classes of the Turkish community, and cultivate the almost inexhaustible resources of this great empire.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

MEETING AT SOUTHAMPTON.

Each succeeding year agriculturists look forward with fond anticipations to the exhibition of new inventions and improvements in engines, machines, and implements for farming purposes; and persons assemble from all parts of the country, with eager hopes at the appointed spot, which is too often, as in the present instance, badly selected. Southampton and its neighbourhood feel little interest in agriculture, and the distance from the districts where the best manufactures are carried on, is such, that many of those who would have taken a part in the labours of the Society, are prevented from furnishing the results of their knowledge and experience; whilst, on the other hand, the chance of sale of the different articles becomes exceedingly limited. One great defect is the permission granted to persons to exhibit implements with which we have long been familiar, and which have no recommendation in themselves, and, therefore, are loudly puffed by the proprietors. A vast proportion of the Society's show this year consisted of articles which might have been altogether omitted. There should be a committee, with the power of restricting the inordinate desire which some men seem to have of bringing their manufactures constantly before the public, without their possessing any marked utility, or differing from those in ordinary use. The large area, which contained no less than 96 stands, might have been much more usefully applied, than to the reception of one half of the articles, many of which have made their rounds at every meeting that has yet been held.

We are not satisfied with the plan adopted of giving prizes for the implements already exhibited, although we are willing to acknowledge that the drill for general purposes, invented and manufactured by Mr. Richard Garrett, is one of much value, combining economy with great efficacy. We object to its being placed again for competition, after having already received the prizes at Cambridge in 1840, in Liverpool in 1841, and at Derby in 1843. It is true that some improvements have been made, but they are not of such a character as to merit for them the first prize of the Society. To the Earl of Ducie was also assigned a premium for a patent chaff cutter, (an engraving of

which has appeared in the Polytechnic Review,) although this machine gained a prize at the meeting at Liverpool.

Amongst those who gave new implements must be enumerated Messrs Barrett, of Reading; Teago, of Yoxford, Suffolk; Bruce, of Stratford on Avon; Hill, of Dudley; Ward, of Stratford on Avon; Jenner, of East Bourne; Twist, of Bridgetown; Cambridge, of Market Lavington; Porter, of Beaminster; Bigg, of Banbury; Hon. P. J. Locke King, of Woburn Park, Chertsey; Moody, of Marden Bradley; Vingo, of Penzance; Corson, of Westminster; Bailey Denton, of Gray's Inn; Clark, of Romsey; Edmunds, of Banbury; Howard, of Bedford; Etheridge, of Furnival's Inn; Kerkwood, of Tranent; Mansfield, of Sherborne; Parkes, of Birmingham; Hornsby, of Spittlegate; Hon. W. Nugent, of Higham Grange; Plenty, of Newbury; Selby, of Lewisham; Sharp and Fluder, of Southampton; Sims and Brown, of Tollard Royal; Smith, of Gloucester; Tasker and Fowle, of Andover; Wedlake, of Hornchurch; Coombs, of Skipton; the Earl of Ducie; Smith, of Hampton Lovell; Cottam and Hallen, of Winsley-street, London; Dean, of Birmingham; Garrett, of Saxmundham; Cook Grant, of Stamford; Hall and Co., of Cambridge; Richmond, of Salford; Sanders, of Bedford; Stacey, of Uxbridge; Wedlake and Thomson, of Romford; Smyth, of Yoxford; Wood, of Knutsford, Cockey, of Frome; James, of Fish Street, London; Urry, of the Isle of Wight; Stratton, of Bristol; Crosskill, of the Beverley Iron Works; Parmiter, of Southampton; Ransome, of Ipswich; Webster, of Hounsdown; Fance, of Frimley; Pearce, of Andover; Read, of Piccadilly.

Besides the implements, there were many articles which need scarcely be brought before such a Society; Mr. Edgington's tents are too well known, books, saddles, varnishes, geological formations, manures, diseased corn, are all well in their way, but they encumber an exhibition of this kind, distract the attention, and cannot be ranked amongst the legitimate objects of a display of the industry and ingenuity of the mechanic who lends his abilities to the promotion of agricultural improvements.

Messrs. Ransome, of Ipswich, Suffolk, bore away four prizes; the first was much examined, it was a patent tile machine, invented by Mr. Etheridge, of 11, Furnivals Inn: to it was awarded a premium of twenty pounds and a silver medal; it is an efficient and economical apparatus.

A prize of 30*l.* was given for a set of horse works for driving a chaff-engine, bean-mill, and other mills, for bruising and grinding grain, either separately or at the same time, all working within the circle described by the horse. This implement is exceedingly ingenious, and excited great admiration.

Lowcock's Patent Plough.—The peculiar advantage in Lowcock's patent plough is, that its construction admits of turning and laying the furrows all at the same angle, and in the

same direction, to the right or left alternately, as it passes up or down the field; thus combining the properties of the turn-rest plough with the advantage of retaining the curved form of mould-board, as used on the most approved single ploughs. It is formed, with two shares, and the front curves of the mould-boards are counterparts of each other; while the hinder curves of the mould-boards are formed by a fly, which, turning on a centre, alternately presents the continuation of the curve of either the right or left mould-board, as required to be used. The handles are attached by a hinge on the centre of the plough, and are the only parts which require to be shifted in transposing the direction of the plough. When the ploughman has completed the furrow turned to the right, he reverses the handles; at the same time the draught-chain, to which the horses are attached, is, by the act of their turning, carried on a rod to the opposite end of the plough. The fly on the mould-board, by its own pressure against the soil, assumes its correct position, and the implement is at once in order for turning the furrow to the left without further adjustment.

A new patent plough received 10*l.* and a silver medal; it admits of adjusting the pitch of the share either to take more or less hold of the ground laterally, to give it an inclination more or less towards the land. Mr. Garrett gained three prizes, the first of 20*l.* and a silver medal.

A Drill for general purposes.—The additions in the construction of this improved drill are, a double-action stirrer is introduced into the manure department, having a perpendicular and also a revolving movement, by means of which the manure which in the drills hitherto in use has frequently clogged and hung back in the manure box, so much so as to require the attendance of a man to prevent it, is in this constantly disturbed and pressed forward into the departments for the depositing barrel, and causing an equal distribution in exact quantities of the most difficult, coarse, or badly prepared manures.

In the working of the seed-sowing engine, as before constructed, the difficulty which has hitherto presented itself of mixing together the heavier with the lighter seeds, the heavier have, by the motion of the engine, been shaken to the bottom of the box; being thereby sown in very unequal proportions. To remedy this, the small heavy seeds, such as clover, trefoil, &c., are delivered from cups, while the lighter grass seeds, such as rye-grass, &c., are, by the same operation, brushed out of a separate apartment of the box, down the same conductors with the other seed; this easy and simple method, whereby the required quantities of each seed are nicely mixed, and evenly sown all over the land, deserves particular attention, and is regulated by merely turning the screw at the end of the box for rye-grass, and changing wheels on the cup-barrel, for clover, &c.

To accommodate the drill to suit any kinds of land, however

hilly, an improved and simple apparatus is provided, so that though the deposit of the seed in going up or down hill be ever so irregular, (which is always the case to some extent,) the man in attendance (without stopping the drill or altering the course of the horses) is enabled, by merely pressing down one handle and raising another, to alter the gear of the wheels, and put on a slower or faster speed, as may be required; this is effected by a wheel on each end of the delivering barrel, one of larger dimensions than the other, so that if the drill is getting on a certain quantity when going up hill, by altering the gear when going down, the quantity deposited is rendered precisely the same; whereas, if the barrel always worked from one-sized wheel, whether going up or down hill, the quantities of seed delivered would be found very irregular; this is of infinite importance to heavy land farmers, and should claim their particular attention.

A patent horse-hoe.—This is fully suited to drill cultivation. It obtained a silver medal.

A patent rack stand, all wrought iron, may fairly be said to be an effectual protection against rats and mice, and of great value to the farmer: it gained a medal. Earl Ducie obtained four premiums. The Polytechnic Review contains in former numbers specimens of the excellent products of Uley, and we hope we shall be enabled to furnish some illustrations, in a future number, of the articles exhibited. The Uley Cultivator and the patent chaff-cutter, for each of which his Lordship was assigned a prize of 10*l*. and a silver medal, have appeared in our former series, besides which, a set of screw spanners and a Richmond cart received a silver medal. The cart is remarkable for the easy way of adjusting the load when descending hills. This is done by a rack and pinion, so that the load is quite under the control of the driver, either for this purpose or for tipping out the load. The pinion is acted upon by a handle, and by the means of a catch or stop the load is kept fast at any required angle. The wheels are made with improved cast-iron naves, fitted with chilled boxes and case-hardened axles; the cast-iron naves are bored out, and the boxes turned to fit nicely, so that if by any means a box is broken, it can easily be renewed. It also contains a reservoir for the oil, so that they will carry it for a great length of time without the trouble of taking off the wheels to grease; the oil is poured in at a small screw-hole provided for that purpose. The mortices for the spokes are made nicely taper, to insure the proper fitting of the spoke. One of the great advantages of these axles and naves is, there is no projection beyond the face of the wheels. This cart has Thatcher's patent break attached. Price 19*l*.

The improvement in screw-wrenches or spanners consists in the application of an adjustable jaw, opening at the end instead

of the side of the handle or lever, by which arrangement it may be more readily used in confined situations. It will be found a very useful tool to the farmer in his machinery or implements, there being generally so many different-sized nuts about them. The easy manner of adjustment is a sufficient recommendation.

Mr. Crosskill's clod-crusher, of which we have elsewhere spoken highly and given an illustration, received, very deservedly, 20*l.* For rolling corn upon light lands as soon as sown, it is invaluable.

Mr. Richard Stratton gained three prizes, two silver medals and 5*l.*, for three carts; one, a water-cart, obtained a silver medal at Derby. The harvest cart keeps the load well together, and the agricultural cart is a perfect spring cart for general purposes.

Mr. David Parkes gained 5*l.* for a churn, and a similar sum for an expanding horse-shoe. The churn has a reverse motion, which acts upon the milk more than one continued motion.

Mr. Smyth received 10*l.* and a silver medal for a turnip drill, depositing manure with the seed. This ingenious implement, which attracted much attention, is prepared for drilling ridges or broad work, with rolls attached for rolling the land before and after the manure and seeds are deposited, the fore rolls guiding the coulters upon the tops of the ridges, whether regularly or irregularly ploughed, with improved sliding hoppers, and other tin apparatus, so as the same can be easily adjusted for the purpose of conveying the manure and seeds perpendicularly down from the box to rows of various widths, also with sliding axle. The rolls are easily detached when not required.

Mr. D. Coombs exhibited an agricultural cart, for which 15*l.* and a silver medal was assigned. Its advantage is, that it can be converted into two good Scotch carts for manure or harvest work.

Mr. Hornsby had two prizes: for a two-row drill presser for conducting seed and manure into the ground, he received 10*l.* and a silver medal, and 5*l.* for a cake-crusher. It breaks the cake for beasts, sheep, and calves. It had a prize last year at Derby.

The indefatigable Mr. Read, of Piccadilly, likewise gained two prizes; one of 10*l.* for a patent turn rest plough, and 5*l.* for a fire engine.

Messrs. Hall and Co. obtained 5*l.* for a trefoil and clover-seed drawing machine. The principal working parts of this machine are the drum and cylinder. The interior of the drum consists of a series of ribs composing a diminishing screw, in which works a cylinder at right angles to the screw, by means of which the seed is drawn in a graduated manner from one end of the drum to the other. It does not injure either the seed or the chaff, and will draw 48, 60, and up to 100 bushels

of trefoil in ten hours, and from 30 to 40 bushels of clover seed per day. It can readily be attached to and worked by any power not less than four horses.

A set of patent diagonal iron harrows, which had won for Messrs. Sanders 5*l.* at Derby, were equally successful on this occasion.

Mr. John Bruce gained 5*l.* premium for an ingenious skim plough; Messrs. Tasker and Fowle a silver medal for a set of iron machinery for drawing water. This is adapted to wells of any depth, and works with two baskets.

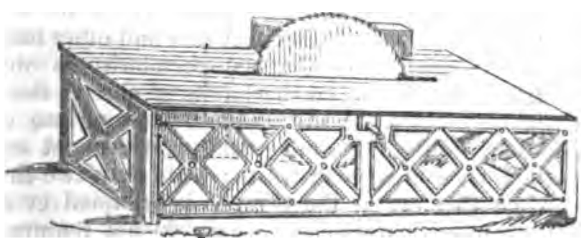
Mr. Stratton had a silver medal for a cheese-press, and 2*l.* for a bone-breaker. This gentleman had several very curious machines, amongst them an equirotal farm waggon. In this waggon, the defects which are urged, by the advocates for the exclusive use of carts, as the chief objections to four-wheel carriages, are removed; and in hilly districts they will be found even preferable to carts, from the power of the horses being exclusively applied to the draught of the load. In this waggon, two horses of average size and strength have drawn with ease three tons on ordinary roads. In addition to the advantages of equirotal wheels and the cross-lock, nearness of the top of the body to the ground is remarkable, by which a great lessening of the labour of loading and unloading is effected; the great length and breadth of the body, by which the load may be kept low, a great object in hilly districts, and Thatcher's patent self-acting drag, which will be found to increase its utility. It is fitted with long portable hay-ladders before and behind, the addition of which enables it (in a hilly country especially) to carry larger loads, and with much greater safety than can be carried by an equal number of horses in carts.

Mr. Cambridge's steam engine received only a prize of 5*l.*, but was the theme of universal approbation, and attracted a large portion of the scientific spectators. This engine is remarkable for simplicity of construction, having fewer working parts than any steam engine yet shown to the public for agricultural purposes, &c.; consequently, more effectual, and less liable to get out of repair, and can with perfect safety be managed by the most inexperienced lad. Its portability is such, that it can, with the greatest facility and despatch, be transported (by three horses) from one farm to another; its superior parts insuring its fitness at all times for immediate use. The steam generator, or boiler, is constructed so that the slightest danger is not apprehended arising from sparks from the chimney or fire. It is entirely cased with wood, preserving it from the weather: by this means a very considerable saving in fuel is experienced. At the extremity of the boiler is attached a tank for the reception of feed water: the chimney flue passes through it, giving off its heat to such a degree that the water becomes boiling hot. A twofold advantage is obtained by this

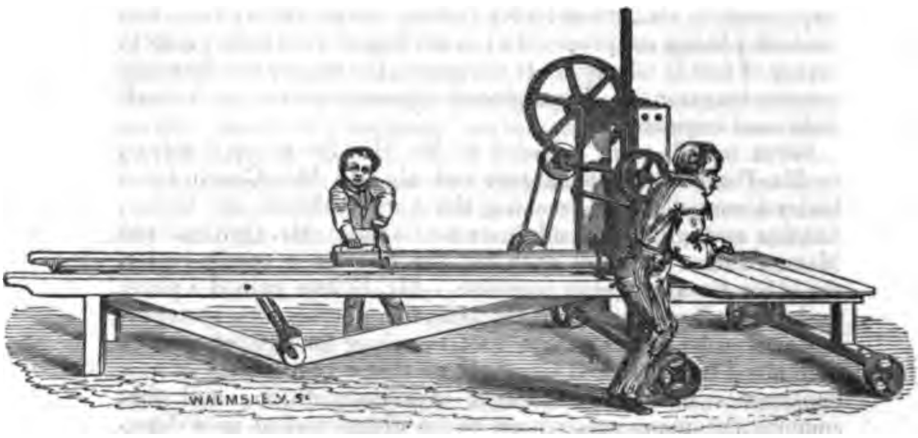
improvement, viz., the chimney is kept comparatively cool, and the boiler being supplied with hot in place of cold water, a great saving of fuel is effected. If necessary, the engine can be made a steam irrigator, or fire-engine of immense power, at a small additional expense.

Silver medals were awarded to Mr. Hill for sheep fencing; to Mr. Pearce for a backband and tag; to Mr. Cooch for a barley-trummeller for breaking the horn or beard off barley, and has strong recommendations for its use. Mr. Gardner and Messrs. James received each 5*l.*, the one for a turnip-cutter, the other for a weighing machine. Mr. Deane gained a silver medal for a hand-mill, and Mr. Hill, two pounds for a wrought-iron cow crib; it has an iron roof, the place for hay being made with sheet iron. It will thus be seen that a vast variety of new implements have been brought into competition, and that amongst the manufacturers are to be distinguished men determined to do their duty to promote those great interests in whose success they are themselves so much bound up. A complete analysis of the exhibition would afford to those who were incapable of being present a fair view of the present state of our agricultural and manufacturing prospects, and enable them to judge whether the sanguine views that are entertained by some of those who watch over the prospects of the land are likely to be borne out. We think much remains to be done, and that more good may result from these annual exhibitions, if the quantity was more restricted and the quality improved.

Besides these implements, to which prizes were awarded by the judges, there were many which richly deserved the praise that was bestowed upon them. Amongst the exhibitors, Messrs. Cottam and Hallen were prominent, and no less than seventy-eight articles were placed before the public, several of them new implements. An iron-framed saw-table was particularly remarked. By this machine timber may be cut to any width, or



with any angle suitable for weather boarding. Their apparatus for moulding drain tiles, simple in construction and requiring but few hands, was among the important features of the exhibition. By varying the pattern-die, it can be accommodated to any shape of tile whatever—round, horse-shoe, flat, &c. Being simple in construction, it requires but little previous practice



in the working of it. It requires one man, to fill and change the cylinders; a youth, to force down the piston, by turning a winch; and two boys, with rollers and cutting wires, to take off and deposit the tiles. Messrs. Cottam and Hallen displayed the same anxiety to give information that they did before the Royal Institution of Great Britain, when Mr. Cottam delivered his valuable lecture upon machinery and implements, during the last session.

Mr. Philips, of Bristol, had a turnip-cutting machine which has many advantages over those in common use, and as a new implement, was favourably received. This machine cross cuts the pieces of turnip into lengths of an inch and a half; it makes few chippings, and divides the last slice of every turnip into the same kind of pieces as the rest of the turnip. The liability which exists in all other machines for the turnips to wedge each other up in the hopper is removed in this by the motion imparted to the body of the machine. The first and last of these peculiarities are those in which the principal difference betwixt this and other machines consists. The advantage of the last peculiarity is obvious: that if the first is dependent on the habits of sheep; these animals do not bite but break the pieces of turnip into shorter lengths, and in doing this rout vast quantities out of their troughs, which occasions great waste; more than two-thirds of the time when they are at the troughs is occupied in sorting the food over to pick out pieces which do not require to be broken, and this it is which gives that very soiled appearance to the surface of the cut turnips long before they have eaten even a third of the whole, and which makes the remainder very unsavoury.

Messrs. Crosskill exerted their usual ingenuity, the result of which has been a display of many improved implements and several new ones; amongst these are a pair of new patent wheels.

By the invention of machinery, driven by steam-engines, these wheels are better, firmer, and more true, than when made by hand. The naves are made of iron, cast upon steel pins and turned true, and fitted to case-hardened turned arms, and wrought iron axle. The spokes are of well seasoned English oak, turned and fitted with double shoulders into the felloes. The ash felloes are finished and fitted by machinery, and the hoop tire is also fitted and hooped by machinery.

A potato steamer and apparatus was much lauded.—This new invention is upon a very simple, but most effective principle; a boy may attend to it without the least danger of accident. It possesses the advantage of durability. The same furnace or boiler can be used as a washing or brewing copper, without any extra expense. The apparatus is suspended to an iron bar, upon which it rides on two wheels, and is raised above the boiler by pressing down the handle; the steamer hangs upon two pivots in the iron bow, and admits of its turning over to empty the steamed potatoes.

Mr. Dean, of Birmingham, had many useful inventions, amongst them a patent pulping or grating mill for grinding fruit for cider, wines, and for reducing to a pulp turnips, potatoes, and for making arrow-root and starch. It having been suggested in the Society's Report, (vol. iv. part ii. p. 489,) in commenting upon the merits of the preceding Bretforton cider mill, that the saccharine matter was much better evolved, and the pips in a great measure reduced, by *grating*, than by the old rolling mill hitherto used for cider making, this mill has been constructed so as to carry out the *grating* principle in the highest perfection, all descriptions of moist fruit or roots being reduced by it to fine smooth and soft pulp, of the consistence of rich cream, which is not only highly approved of by cider makers, but is of essential value in the manufacture of arrow-root, starch, &c., &c. This machine is adapted to one or two men, and to horse or steam power.

A portable steam-engine was amongst the best things exhibited.—This engine will be found to answer the purpose of many farmers full as well as one of greater power, being equal to the performance of much more work in cutting chaff and turnips, bruising corn, grinding, &c., than is required to be done upon farms of moderate extent; and when employed in thrashing, it has been declared by many farmers to be equal to four horses. It is more portable than engines of larger power, and is drawn with ease by one horse. The three-horse power engine of this description is also an exceedingly useful farmer's engine, and calculated to drive the usual four-horse thrashing machines to much greater advantage than by animal power. These steam engines being exceedingly simple and free from complicated movements, are easily managed, and not liable to get out of order. They are fitted with superior metallic pistons,

thus obviating the trouble of packing, and the risk attending its being improperly performed by inexperienced hands; and with metal slide valves in lieu of steam taps, which are continually out of repair, they will be found much more durable and efficient than engines with *vibrating* or *oscillating cylinders*, and are warranted equal to the power stated. The *fixed* steam engines, which in many instances will be found more profitably useful than *portable* engines, inasmuch as where the barn is adjoining to a convenient building for fixing the chaff and turnip cutter, corn and cake crushers, bone mill, flour mill, cider mill, and other useful machinery, the same engine may be made to thrash the corn and to drive any number of the smaller machines, without removing either the engine or any one of the machines; whilst the steam from the engine boiler may furnish the necessary supply to the apparatus for steaming and cooking. A *fixed* engine is managed with less trouble than any description of *portable* engine, owing to it and the machines it is intended to work always remaining in the proper situation for connecting to each other.

Having thus spoken of the principal articles which found favour in the eyes of those for whose inspection they were intended, we have only further to point out the absolute necessity that exists for the study of the great principles upon which mechanics are founded. We could point out in the voluminous catalogue which is placed before us, the most deplorable instances of a want of knowledge of those fundamental laws upon which motion and power depend. We have numerous cases in which greater power is required to set a machine in action than is necessary, and we have other proofs that there is not that due appreciation of what really can be effected by mechanical means. We have felt on some occasions inclined to recommend an inventor to study the given laws which are laid down even in our elementary works, for we have seen so much ingenuity exerted to produce impossible effects, that we have arrived at the conclusion that those who have some excellent idea in their minds, should place themselves in the hands of some skilful practical man, before they attempt to incur the expense of trying their powers, and of producing something similar to that which has already failed. We should like a series of lectures to be delivered before the Agricultural Society, not only on chemistry, on zoology, and mineralogy, three of the most important branches of knowledge for the cultivator of the soil, and for the rearing of animals for food and domestic purposes, but also on mechanics, that the farmer and his friends may learn how best to turn to advantage the means which art has placed in his hands, for the avoidance of those laborious efforts which must be made when mechanical assistance does not aid manual labour. The vast improvements that are hourly making, lead us to the belief that much of the industry has been

badly directed, and that the resources which exist are but imperfectly understood. Most anxious shall we be to point out some of those fallacious views which have been taken by some of those inventors whose works have been before us, and we trust that we shall be enabled to afford in our next number space for some of those remarks, which the late period of the month at which the meeting was held, has so completely precluded us from giving on this occasion.

THE WHITE MISTS, OR TABLE CLOTH, AT THE CAPE OF GOOD HOPE.

By Mrs. Borron.

The appearance of the Table Cloth, as it is termed by the inhabitants, on Table Mountain, has hitherto been deemed extraordinary, and has not, I believe, been before accounted for. The beautiful description I here introduce, is taken from Mr. Webster's account of the voyage of H. M. S. Chanticleer, Captain Foster.

"When a south-east wind, passing over the southern shores of the Cape, prevails sufficiently to surmount the Table Mountain, the first notice of the fact is a little mist, floating as a cloud on a part of it, about ten or eleven o'clock in the forenoon. By noon the mountain becomes fringed with dew, and half an hour after, a general obscuration takes place by the mist. In another half hour the little cleft between the Devil's Berg is capped by the cloud; the Table Cloth is now completely spread, the south-east wind, the progress of which has been thus arrested, now forces its way onwards, and rushes down the mountain into Table Bay with the utmost violence, producing loud and terrific noises in its course, and accompanied by a most curious exhibition. This phenomenon lasts till about five in the afternoon, when a little clearing, which takes place on the western edge of the mountain, announces that the Table Cloth is about to be folded up. By six or seven the clearance has considerably advanced, and by eight or nine every vestige of it is gone, and nothing is seen about the mountain but an ethereal sky, and the twinkling stars."

From the preceding account of the phenomenon at the Cape of Good Hope, called the Table Cloth, its solution appears not to be understood. Having frequently observed upon the tops of high insulated mountains in Scotland, for instance, on Tinto Top, in Lanarkshire, on hot summer days, similar appearances as to the first part of the affair, I am induced to send you, what appears to me, an elucidation of the cause, and also of the effect under higher degrees of temperature.

The appearance I allude to on Tinto was this: with a west wind, about twelve at noon, at about a quarter of a mile from

the mountain, in a clear blue sky, were observed white fleecy clouds beginning to form from the west, increasing in size as they approached the mountain. The mountain top was enshrouded in white, the edges of the mist varying in shape as the wind passed, and portions becoming detached through its power, floated away to the east, to about the same distance, or rather more than when formed on the west. Now I consider the cause of these appearances to be as follows:—Although the sky was clouded, yet a considerable quantity of warm vapour was held in solution and invisible until it began to give out its caloric to the cold top of the mountain as it approached; it then took the form of light condensed vapour, and was held on the mountain in that state, so as to completely envelope it to about 500 feet down the side. The wind continuing, parts were detached and sent off to the east, when, as they again received fresh caloric from the atmosphere, they again became invisible.

Taking this as our guide to Table Mountain, and observing the difference of the latitudes, viz., 56° N. in Lanarkshire, and 34° S. at the Cape; and considering the heat that a south-east wind acquires, in passing over a part of the Indian Ocean, and over the sultry plains of Africa, on its eastern coast, we must be convinced that the atmospheric current presented to the insulated mountain at the Cape, must have far exceeded the temperature of the air in Lanarkshire, and have been surcharged with much greater quantities of vapour in suspension, although alike imperceptible until its approach to the mountain. Again, Table Hill is at least 1700 or 1800 feet higher than Tinto, and consequently, notwithstanding it is in a far lower latitude, it is colder. The height of Table Mountain being 3,582 feet above the sea level, and Tinto Top not above 1,800. The magnitude of the two must also be taken into account, the former as presenting a much larger surface of cold to the warm vapour. The vapours also arising from the hot plains of Africa, are not only greater in quantity, but more highly heated.

In all countries within and near the tropics, the vapour is considerably more abundant during the day, and is speedily deposited after sun-set; the blue of the sky is consequently more milky in its appearance after nine or ten o'clock A. M., but when the vapour is either deposited in heavy dews, or partly carried off as clouds, the nights are clear and beautiful beyond all we ever witness in higher latitudes. In the eloquent language of Coleridge,

. . . . . . "The hue
Of sea and heav'n is such a blue
As England dreams not, there the night
Is all irradiate with the light
Of stars, like moons, which hung on high,
Breathe and quiver in the sky.
Each its silver haze divine,
Flinging in a radiant line."

I have mentioned the foregoing circumstances in order to show that in low latitudes the evaporation is enormous during the day; so much as nearly half an inch perpendicular, from sunrise to sunset, made in experiments of five successive days, in latitude 16° N. at sea; and upon this the whole of the successive phases of the phenomenon of "the Table Cloth" upon the Table Mountain depend.

Having shewn the causes of the formation and spreading out of the Table Cloth on the mountain, I now proceed with the result.

On the caloric of the vapour being abstracted by the mountain, first heavy dew is formed, and as the heat of the sun begins to decline, the warm vapours decrease in quantity, whilst the abstraction of heat by the mountain continues; at length the whole atmosphere at the top of the mountain has been progressively cooled down, but the heat of the atmosphere at the foot is very little reduced; and the weight of the air above, being considerably heavier than the air below, it begins to descend, and increasing in violence during its descent, in the usual ratio of descending bodies, a tempest ensues.

In the instance of Tinto, the accumulation of mist is not often followed by currents of descending air, on account of the vapour not being so heated, and, moreover, not infinitely so large in quantity, and the size and elevation of the mountain not presenting so cold a surface, and the warmth of the ground below not having been equal to rarefy the atmosphere, in any thing like the proportion, as at the Cape of Good Hope.

In tropical climates the above is, perhaps, the proper solution of the land breeze at night, and *vice versâ* in the day. In fact, varying condensation, rarefaction, and evaporation, are the great causes of wind, from every point of the compass over the earth, excepting the trade winds, within the tropics, which owe their rise to the diurnal motion of the earth.

I am aware that electricity has a good deal to do with condensation, and rarefaction; but that I need not here observe upon, although it is undoubtedly present.

I may resume the subject of electricity some other opportunity, especially as I perceive one of our correspondents has treated it as the cause of earthquakes, and of magnetic attraction, as well as of the variation of the needle.

PATENTS.

No. I.

PAPERS ON THE PATENT INVENTIONS OF GREAT BRITAIN, AND ALL FOREIGN COUNTRIES, GRANTING THE PRIVILEGES OF A BREVET.

It is intended that this division of our miscellany shall form a continuous series of papers, of permanent character, on this im-

portant branch of our national economy, and this conducted with an earnest view both to the scientific and commercial bearings of a question which becomes every hour more seriously connected with the national power and prosperity. It will include the popular history and statistics of the subject—periodical statements and disquisitions on the practical workings of the system in our own and other countries, and current accounts of such recent patents, as are most important to the interests of science, and the general advancement and welfare of its patrons and cultivators: verbatim copies of the specifications of such leading patents, with full transcripts of their drawings, and careful professional abstracts and analyses of all others, falling in rational and mature judgment within the limits of the prescribed condition.

In the infancy of the scientific and useful arts, Royal Patents, or grants of exclusive privileges, originated simply in a desire on the part of the Government to reward the attachment of its subjects, in particular cases, by the personal gift of a valuable immunity. This system, as the principles of commerce and national industry became better understood, gave way to the wiser policy of modern times, in which the grants of the sovereign became identified with the public welfare. The royal prerogative, which in this respect had been too frequently exercised with an indiscriminate and hurtful profusion, was by the public voice placed within the just and rational limits best suited to attain the legitimate objects of legislation. The modern and beneficial system of patent grants may be said to derive its origin from the exertions of two enlightened statesmen of countries famed in the history of the world for their generous rivalry in those arts of civilization, which have in fact been powerfully advanced as a consequence of that system—Burleigh, in his character of minister to Elizabeth of England, and Colbert, of France.

In England, the patent laws of modern times have fostered its spirit of enterprise and its arts, to an extent not to be expected from any other system of reward. In France, a new and comprehensive law of patents, promulgated towards the close of the eighteenth century, gave a new stimulus to the genius and talent of its people, by securing to every man the full fruit of his labour and his ingenuity. A legislative measure recently passed by the French government in such an extension of this law, as the modern condition of the mechanical arts imperiously demanded, has completed for France a state of security for scientific invention, to which we look with an earnest interest as a model for the improvement of our own system of patent laws. To the discussion of this subject we shall recur from time to time.

The high and improving state of the scientific arts, in these closely neighbouring countries, taken together with the rapid international exchange of the benefits derived from those im-

provements, give the patent laws of each an increasing interest to the people of the other, and render a practical knowledge of their construction, and their operation, nearly indispensable to every person, either of France or England, who is engaged in active business.

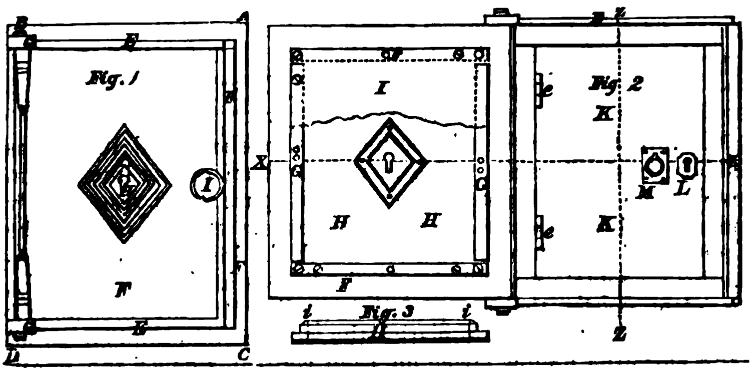
Much and serious inconvenience has hitherto been felt in France, by all classes of persons interested in the affairs of patents for new inventions, by the want of distinct and accurate information respecting the precise nature of the patent laws of both countries, and by the conditions and restrictions under which the privileges of a patent are granted by their respective governments, and the formalities to be observed in the proceedings for obtaining the grant.

Specification of the Patent granted to Edward Tann, Sen., Edward Tann, Jun., *and* John Tann, *for* "*certain Improvements in Locks and Latches, and in Iron Rooms, Doors, Safes, Chests, and other Repositories.*" Sealed Nov. 25th, 1843. With Engravings.

After the usual preamble, the patentees declare in their specification that the nature and intention of their invention consists in and has reference to the principle of construction and action, the modes of arrangement of the mechanical parts, and the combinations thereof as described, and applied to the constructing locks and latches of security in an improved and more efficacious manner than has heretofore been done, and also in the particular construction, modes of fitting and preparation of safety and fire-resisting chests, rooms and other repositories of security against the destructive effects of fire, and of surreptitious attempts to open them; and also in the particular application of such locks and latches of security against surreptitious opening, to such safety chests and other repositories of security against the destructive effect of fire; they further declare the particular and practical nature and intention of their invention to be, Firstly, the construction and the mode of fitting and preparing such safety and fire-resisting chests, rooms, and repositories of security as render them fire-proof as regards their interior area and chambers or receptacles, such construction and the mode of fitting and preparing the same, consisting, firstly, in the adaptation of an outer or double body to the outer side of a second or inner body of the chest or room, and having its several sides placed each at a small distance from the corresponding sides of the second or inner body respectively, thus forming empty spaces or cavities between them; Secondly, in that having thus provided such empty spaces or cavities so surrounding the said second or inner body between itself and the inclosing outer or double body, that such spaces or cavities are afterwards closely filled up with a composition and mixture

of certain chemical matters and substances, with certain other substances being non-conductors of heat, (which are after described;) Thirdly, in constructing a third and interior casing or lining to the second or inner body, and formed of wood or of any of the known non-conductors or imperfect conductors of heat, and having its outer side also placed at a small distance from the inner side of the second body, so as to provide other empty spaces or cavities surrounding such third and interior casing and lining between itself and the second body, which empty spaces or cavities are also afterwards closely filled up with the same composition and mixture of chemical with non-conductors or imperfect conductors of heat, as already herein mentioned, as used to close and fill up the empty spaces or cavities surrounding the second or inner body, and such interior casing or lining being so constructed and arranged forms the immediate place of deposit for the valuables to be placed for security therein, and being so protected by the surrounding composition and mixture of chemical matters and substances, and other substances being non-conductors or imperfect conductors of heat, books, papers, and documents of similar combustible and delicate character are effectually protected from being burned, charred, or scorched, even should the outermost metal body of the chest or room be heated to a white heat; Fourthly, in the application of an outer door to close and secure the outer body, constructed and formed of the same fire proof character as the outer body of the chest and repositories, in respect to such fire proof security, and also of a peculiar construction, effecting a perfect mechanical security against surreptitious attempts to open the same by false keys or otherwise; Fifthly, in the production and application of a composition and mixture of certain chemical matters and substances, with other substances which are themselves and *per se* non-conductors or imperfect conductors of heat, and in such composition and mixture (being after described) being applied and used to close and fill up the said empty spaces and cavities; such composition and mixture being fusible under high degrees of heat, such as would char, scorch and destroy the combustible contents of ordinary iron and safety chests, and which, by the process of such fusion, neutralizes a considerable portion of the heat received by the outer and exposed chest or body, and in such fused state, then posessing an increased power of resistance to the conducting and the transmission of heat, and also in such fused state closing and filling the empty spaces and cavities produced and provided in the construction more completely and effectually than when in the original or unfused state. Sixthly, in the principle of construction, and the peculiar modes of arrangement of the mechanical parts, and the several combinations of such constructions of locks and latches of security, applicable to the safety chests and repositories, and

also in the mode of applying and fixing the same on such safety and fire-resisting chests, rooms, and repositories as after described, the practical result of such constructions and combinations of mechanical parts being the manufacture of locks and latches of security to be applied thereto, and which are more perfect than the locks and latches of security hitherto made, both in their character of inscrutability or safety from surreptitious attempts to open the same by the means of false keys or otherwise, and also in their character of firmness and strength effectually to resist forcible entry or breaking into, and further, also, affording a more commodious use and management thereof.



The figure 1 represents a view of the upper side or top of the aforesaid safety and fire-resisting chest, in which A B C D are the upper edges of its outer body, E E two of the edges of the second or inner body, F F its lid moving in an upward and outward direction on the joints G G, H the escutcheon of the lock, sunken below the general surface of the upper face of the lid for a purpose after explained, I the handle by which the lid is raised.

Figure 2 represents a top or horizontal view of the inner or second body of the chest, in which E E marks its upper edges, as in figure 1. F F is the inner side of the lid thrown open, and G G a metal frame attached to its inner side inclosing a hollow space at H H, which is closed and filled with the described composition and mixture of chemical with non-conducting substances. I is a plate screwed upon the front of the frame G G, to secure and hold such application of the composition in its place. A portion of the plate I is shown in this figure as if broken off, to show the application of the composition. K in the inner part of the body E E is a second lid or cover, hung upon the joints *e e*; this lid closes upon the interior casing or chamber which forms the receptacle for the deposits in the chest. L is the escutcheon of the lock of security of this in-

terior chamber, and M is a lifting ring for opening the lid. The lid is represented in a cross section at the figure 3. As in the figure 2, H shows the composition with which the hollow space of this lid is filled; I its upper or outer iron plate, and *i i i* an inner lining or casing of wood.

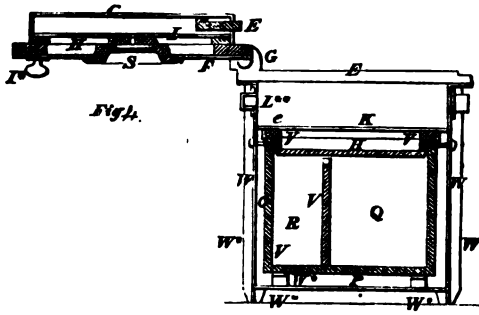
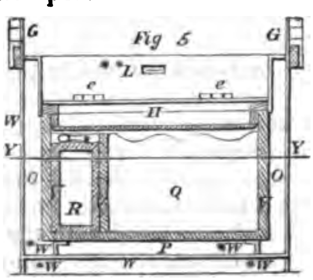
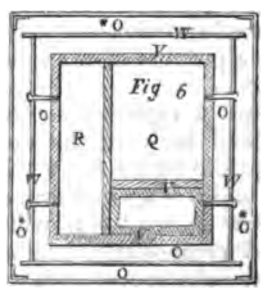


Figure 4 is a vertical section of the chest and its lid as shown in the figure 2, taken in the direction of the line X X, in which the several parts seen in the figure 2 are respectively marked with the same letters of reference. H H represents the portion of the composition with which the inner lid of the interior receptacle K is filled. In the lid F F of the second body, H also marks the composition applied to fill the hollow space of that lid. O O marks the composition applied to fill and close the hollow space on each vertical side of the chest, and P the portion of composition with which the hollow space beneath the interior chamber is filled and closed. Q and R are two compartments of the interior chamber, which is formed or lined with wood as designated in the figure at V V V. S is the sunken portion of the escutcheon of the lock.

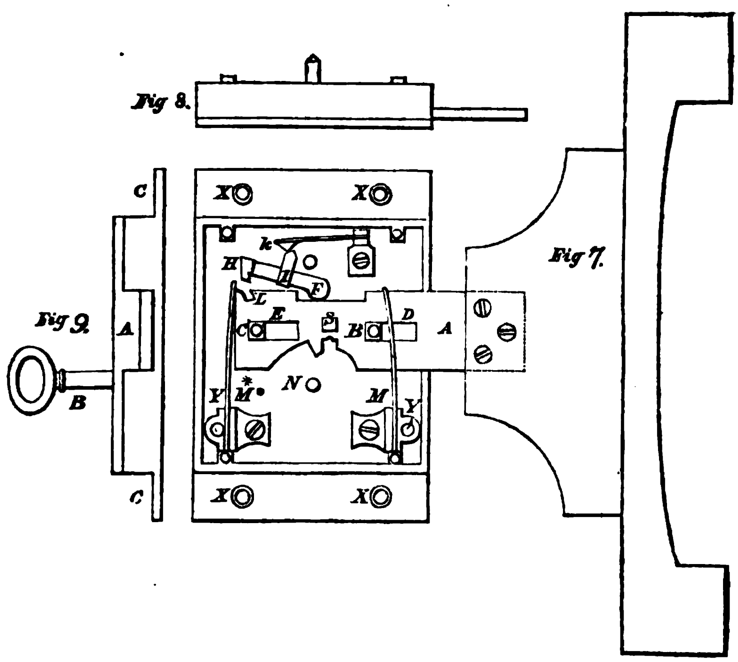




The figure 5 represents a longitudinal vertical section of the figure 2, taken in the direction of a line drawn through Z Z of that figure, the several corresponding parts being marked with the same letters of reference respectively. H, O O and P respectively designate the portions of the composition filling the spaces about the several sides of the body, W W W marking the sides of the body, and W* W* W* W* are edge plates projecting from the

sides of the inner body, and by which it is kept at the proper distance from the outer body, to allow sufficient space for the necessary quantity of the composition to be used in filling up the space thus provided between the inner and the outer bodies.

The figure 6 represents a horizontal section of the figure 5, taken in the direction of the line Y Y.



The figures 7, 8, and 9, are representations in geometrical plan and profile views of the several parts of the lock, in which when repeated they are respectively marked with the same letters of reference. Figure 7 represents a plan view of the inner side of the lock, having its front plate removed, and all its levers taken off, to shew the form of each separately, and to explain their combination, or the order in which they are placed as regards each other, with the fixed and the moveable parts of the lock. The figure 8 is an edge view of the figure 7, as it would be seen from its upper side. In the figure 7, A is a sliding bar, which has an easy alternate sliding motion in the direction of its length, on the fixed stubs or pins B and C, guided by the slots D and E, which move freely on B. F is a bolt or lever, which they term the reliance bolt; this is lightly hung, so as to move easily on a fixed centre pin G; at its opposite extremity it has a crotch or hook H, and at I an upright standing cross bar fixed at right angles to the length of the bolt; the upper extremity of this works against a pallet

k, at the end of a short spring K, fixed at K*. The crotch H is, by the action of one of the levers, made to drop into the notch L of the sliding bar A, by the pressure of the spring K K*. Two springs M M* fixed at their lower extremities, as shewn in the figure, hold two sets of working levers to their required action. N is the pin which receives the pipe of the key. In the figure 9, B shews the key applied to its place, and represents an edge view, or profile of the front edge of the figure 7.

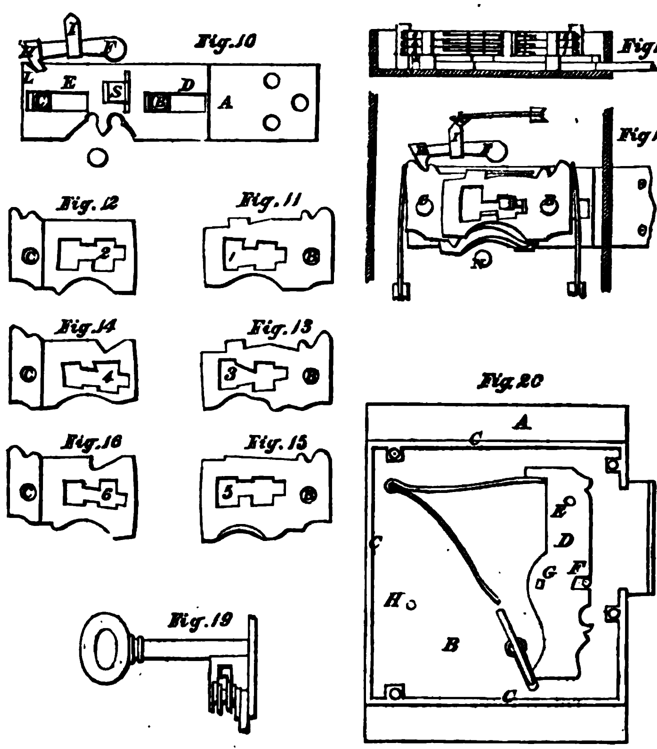


Figure 10 represents a sliding plate, which is the first placed on the square stub S of the figure 7, by a corresponding square hole attaching it to the sliding bar A of figure 7. The reliance bolt I F H is here repeated, and is seen engaged in the notch of the plate at L. The pierced lever, figure 11, is the first placed on the stub B, by its corresponding aperture B; the pierced lever at figure 12 is next placed on the stub C by its aperture C, the pierced lever, figure 13, is placed in the same way on the stub B by its aperture B, and next, the lever, figure 14, is placed on the stub C. The lever, figure 15, is next placed on the stub B, and then the lever, figure 16, is placed on the stub C. The whole number of these levers com-

bined is shewn in figure 17, where the several levers, as far as they can be seen, are placed in the order in which they are described. The figure 18 is a profile view of this combination. In figure 17, the reliance bolt F I H is seen engaged in the notch L of the bar shown at figure 10, and also in a corresponding notch in each of the levers, figures 12, 14, and 16. The action of the lock is thus:—the key being applied to its pin N, it operates by its configuration on the lower edges of the differently formed levers, and the lock is complete. If an attempt be made to open the lock with a false key or other instrument, the configuration of the false key or instrument used not strictly agreeing with the character of the levers in their respective forms and their peculiar combination, the upright piece I of the reliance bolt passes the extremity of the small spring K *k* and its crotch H, then engages in the levers, figures 12, 14, and 16, and the action of the lock is thereby entirely stopped; it cannot be opened. We will suppose the possessor of the true key now introduces it, and turning it in the reverse direction to that employed for opening the lock, or from the right hand toward the left hand, the form of the notch in which the crotch H is engaged, with the form of the crotch itself, acts to disengage it, and causes the upright piece I to pass on the other side of the point *k* of the spring. The disengagement being thus made, if the key be turned from the direction of the left hand towards the right, the lock being now in correct action, it is opened. The upright springs M and M* hold the levers to the requisite precision of action. Figure 19 is a side view or elevation of the key, with its indentations, and their application to the pierced levers shown in section in the figure, and engaged in the key. Figure 20 is a plan view of the inner side of one of the latches of security. A B is the back plate, and C C C edge plates forming the box of the latch; D is an upright lever hung upon the box by the stub E, receiving on the stubs E and F the pierced levers in the figures 21, 22, 23, and 24, and in combination with these, applied on the stub G, and hung on the centre pin H, the pierced levers or latches shewn in the figures 25, 26, 27, and 28, are placed, and on the stubs E and F, is placed the lever figure 6, immediately upon which are placed in succession the levers marked figures 22, 23, and 24, as they are partially seen in figure 28, and altogether in section in figure 29, lying in the order of the enumeration. Next, on the centre stub or pin H, and the square-headed stub G, are placed in succession the levers seen at figures 25, 26, 27, and 28; the key is applied to its pin at I, and acts directly by the configuration of its wards on the curved lower edges of the lever B′ and the other levers situated under it. These levers act upon the lower edges of the sliding lever A′, and those latches situated under it, forcing the extremity K of the lever A, and those situated under it, into the channel L, and so engaging the latch

in its box. The spring M, by its tension, maintains the precision of action of these levers and latches.

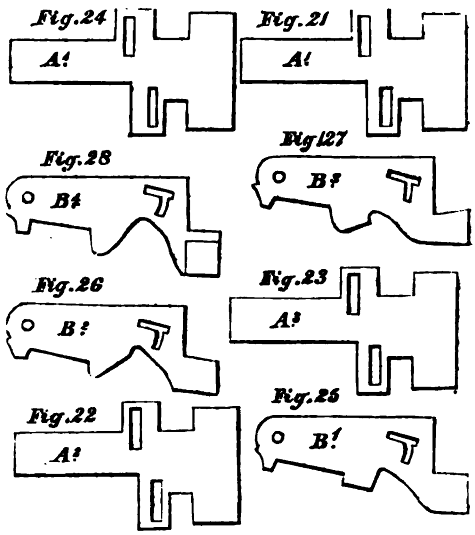
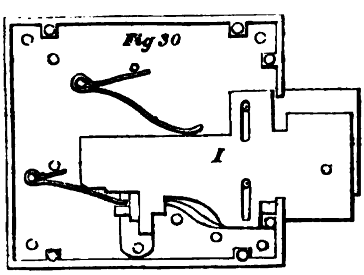
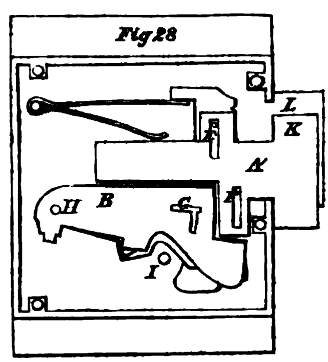
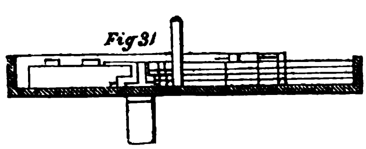
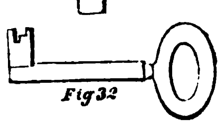


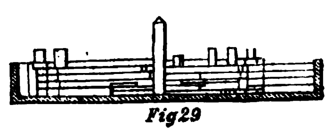
Figure 30 shews another modification of the latch, of more simple form and combination, as is manifest by reference to the forms of the separate levers, and the figures 30 and 31, in which the whole combination is shewn, inserted in the latch and ready for action. The figure 32 is a separate view of the key of this latch. The latch shewn in the figure 30 is termed a perpendicular lifting latch. The latch shewn in the figure 28 is termed a perpendicular lock latch.











The composition and mixture of certain chemical substances with other substances being imperfect conductors of heat, and the mode of applying the same, is thus described:—They take ground alum, finely sifted, and Austin's cement, or gypsum, also finely sifted; they mix either of the latter substances in equal quantities with the ground and finely sifted alum in an iron vessel, and then expose it to a heat sufficient to produce liquefaction and ebullition of the mass; it is necessary that the mixture should be constantly stirred during the heating, and when it is thus liquefied and heated, the mixture is in that state poured into a flat iron tray to cool; it is then in a caked and compact form, and from that state is to be coarsely pounded when required for use. The chamber and empty spaces are to be carefully filled and pressed or rammed down, and when the mass is heated by the exposure of the chest to the action of fire, the composition liquefies and completely fills the smallest fissures in the work, and becomes greatly more compact and dense than before such fusion. Its power of resistance to the transmission of heat is, by its fusion, greatly increased, and it emits no steam. The patentees state this composition and mixture to be what they prefer in practice, but that any non-conductors of heat may be used with useful effect as, for alum, there may be substituted the following substances: sulphate of potash, muriate of ammonia, borax, impure potash, nitrate of soda, soda in cake, pearl ash, or any of the known alkalies. They declare that they claim as of their invention as regards the said composition and mixture for filling the spaces between the several bodies of the safety and fire-resisting chests and repositories; the combination herein stated having the property of liquefying under exposure to high degrees of temperature without steam or expansion prejudicial to the safety of the apparatus to which it is applied, and possessing in its fused state an increased power of resisting the transmission of heat, and also the modes of arrangement for the application of the same, as they have specified them. They claim as of their invention the construction and adaptation of compound and double or triple bodies or cases placed one within the other in succession, leaving separating spaces between the contiguous bodies, and closing and filling such spaces with the heat resisting composition herein described, and these arrangements and constructions as herein specified. They further claim as of their invention the improvement in locks and latches of security, by and through the constructions and combinations as they are described in their specification, and as set forth in the accompanying drawings.—[*Enrolled May* 25, 1844.]

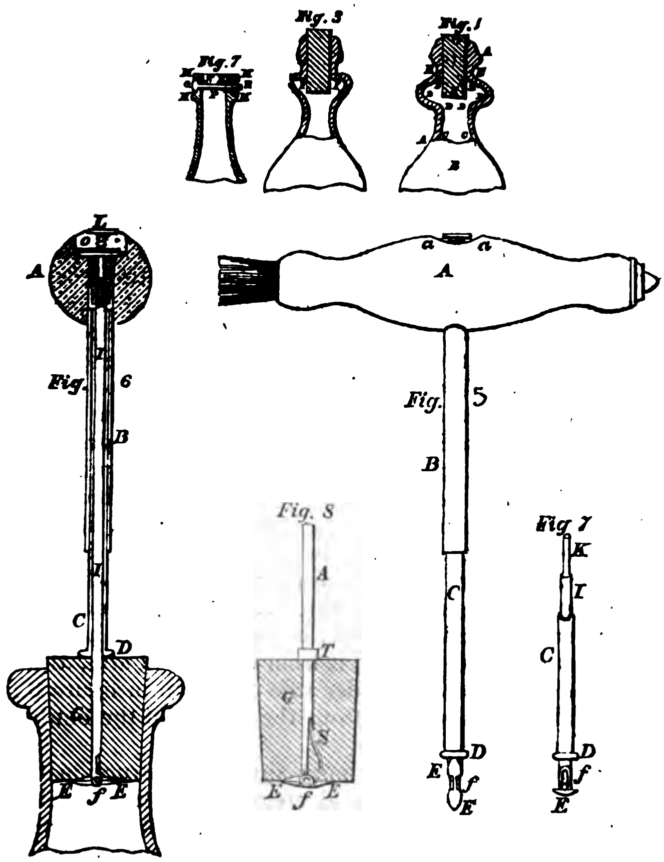
Specification drawn by Mr. Alexander Prince,
14, Lincoln's Inn Fields.

Abstract of the Specification of the Patent granted to ALEXANDER SOUTHWOOD STOCKER, *for Improvements in the Manufacture of Glass and other Vessels as regards the Application of Corks, and the effectual retention of the same, for effervescing Liquids; and in an Apparatus for extracting such Corks.* Sealed Dec. 8th, 1843.

THE patentee declares the nature and intention of his invention to consist, firstly, in the manufacture of bottles of improved forms, with reference to a more beneficial mechanical character obtained for them by such improved forms, and as applied to all the varieties as in common acceptance are considered, in their practical and domestic use, to belong to that class of vessels; secondly, in the manufacture and production of a more effective mode of securing the corks, or stoppers, applied to the purpose of closing such bottles; and thirdly, in an apparatus for the more effectively withdrawing the corks and stoppers from such vessels.

The figure 1 represents a vertical cross section of the upper portion of a bottle, or glass vessel, marked A A, adapted to effervescing liquids, as soda water, and other compounds of similar chemical character; at B B, a partial outer view of the same. It will be seen that the diametral dimension of the neck of the vessel contracts at C C, as in the ordinary vessels used for such purposes, but at a small distance above this point the diametral dimension begins to increase at D D, and such increase is continued, until it projects or swells to a dimension of about double the first dimension, and from that large dimension such dimension begins to decrease in an upward direction, and when such decrease has again arrived at the point D D, then the diametral dimension of the neck of the vessel is decreased to the lesser dimension shewn at E E. Into this smaller portion, or neck of the vessel, the cork G H is passed, its lower portion H protruding below the portion E E of the neck into the larger space. Figure 3 represents, in a vertical cross section, a modification of the mechanical character as regards the form of the upper portion of a vessel applied to the same purpose, in which the increased portion of figure 1 has the form and configuration shewn at I I. The figure 4 represents a form or configuration of the upper part of the necks of bottles, being in other respects of the ordinary and known forms and configurations. It consists in forming in the enlarged or thickened portion of the neck, M M M M, a counter-sunken indentation N N, in which can be applied, in a new manner, the known method of securing the cork, or stopper, to the neck of the vessel, by the insertion of a metal pin through holes made in the opposite sides of the neck, the metal pin passing through a diameter of the cork, or stopper, as shewn in the figure at P. The head of the pin at Q, and its point at R, being thus

placed within the diametral dimension of the projecting rings M M M M, and so admitting the application of a capsule, or external cover, to the cork and the opening or mouth of the vessel.



The figures 5, 6, represent the apparatus for withdrawing the corks or stoppers from such vessels. The figure 5 represents a compound instrument by which such withdrawal is effected. Figure 6 is a longitudinal section of the figure 5, in which the corresponding parts are marked with the same letters of reference. A is a handle of the form generally adopted in the corkscrews of common use. B is a metal external tube attached to the handle A, and passing through the same in a hollowed channel to its opening or mouth on the upper side of the handle A A, at *a a*. C is a smaller metal tube sliding freely within the tube B, and carrying at its lower extremity a stop plate D; within the inner sliding tube B there is also a metal

tube or hollow cylindrical rod I, (to be seen only in the figure 6;) the rod I carries on its lower extremity a doubly fluked arm E E, which moves freely on a pin *f*, forming the fulcrum or centre of motion; the sliding rod I, figure 6, being also hollow and tubular, it allows a small solid metal rod to slide within it. This is shewn at K, in the figure 7, with the tubes C and I, with the stud or stop plate D, one of the flukes E, and the centre of motion *f*, of the fluked arms E E.

The action of this instrument, and its application to the withdrawing the corks or stoppers of bottles is thus:—In the figure 6, G represents a cork or stopper, supposed to be inserted in the neck or opening of a bottle; the instrument having the stud or plate D in the position shewn in the figure 5, where it holds the fluked arm E E closed, is in that state thrust by the point of the lower fluke into the cork; the stud D is thus forced up as the tubular rod I penetrates the cork, and the fluked arm is at liberty to open on its centre pin *f*, when they have passed through the cork, as in the figure: this effected, the small circular plate L, at the top of the handle, and which is fixed on the upper extremity of the inner and solid metal rod K, is pressed down till it reaches the bottom of the cavity O, cut in the handle A; this presses the lower extremity of the rod K against a short inclined rib, formed on the inner side of the fluked arm, it forces it to take a position at right angles to the position in which it was made to penetrate the cork G, and then standing in the position represented in the figure 2, at E E; a small helical spring under the circular plate L, is attached to the head of the rod K, and operates to release it from the fluked arm, the arms holding the cork G on its under side as shewn in figure 6; the operator withdraws the cork from the mouth of the bottle with facility and precision.

The figure 8 represents a more simple construction of this instrument. A is a solid metal stem having the usual cross handle; G is the cork to be withdrawn; the fluked arms E E, set on the lower extremity of the rod A, is held in a closed position, in which it can be made to penetrate the cork, the vertical position being insured by a holding socket T, sliding freely on the rod A. When the arm enters the cork, the socket T is forced to quit the arm, and so releases a small steel spring S, which then throws the flukes into a position enabling it on its exit from the cork at its lower face, to take the horizontal position shewn in the figure, and so enables the operator to withdraw the cork.

The figure 9 represents a secure mode of closing the opening in a glass or other bottle or vessel by a stopper, which cannot be withdrawn but by the operation of its particular key. The figure shows the vertical section of a glass vessel, in which A is the body, B the mouth of its neck, C a

stopper, having a cylindrical hollow space formed in its centre and through its length, E E the cylindrical cavity continued but of smaller diameter, and the stopper terminating in a solid portion, I, fitting closely in the neck of the vessel, as in the usual constructions. In the cavity E E, and attached to the stopper, a branched spring, G G G, is placed, whose tension being outwards from the centre of their assemblage, their bent extremities *g g g* are thrown by that tension into corresponding cavities formed in the portion I, (as shown at *g g g* in the figure 10,) and also afterwards under a shoulder or grooved bearing formed in the neck of the vessel at H H in figure 12.

Figure 10 is an exterior view of the stopper in elevation.

Figure 11 is a view in side elevation of the key with which this stopper is released in order to be withdrawn, in which A is its stalk or stem, B B its arms, of which C C are the extremities. Its action is produced by inserting its arms B B within the cylindrical aperture E E of the stopper in figure 9, and pressing its extremities C C downwards against the shoulders *g g* of the springs G G; this pressure and its action upon the springs closes them towards the centre and so withdraws them from their position of holding in the neck of the vessel; the stopper can then be withdrawn by hand.

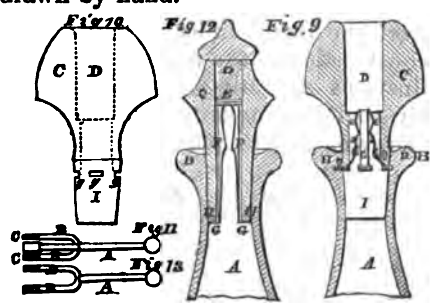
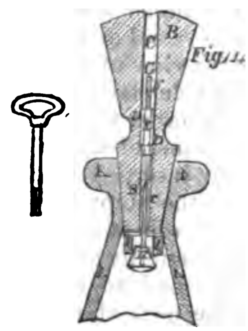


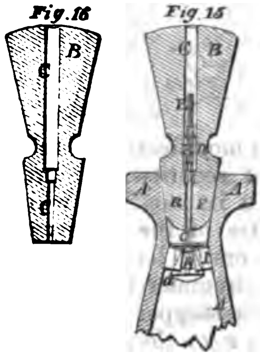
Figure 12 shows a modification of this principle of construction and a stopper of security. A represents a portion of the body of the vessel; B its mouth, in which is inserted a stopper C; through the centre of the stopper C a cylindrical cavity is formed through its entire length, at F, a circular metal plate resting by its entire circumference on a bearing shoulder formed in the solid part of the stopper C. To the centre of the plate E are fixed the springs F F; these have a small portion of their lower extremities turned outwards, and at right angles to their length, as shown at G; these portions pass under the lower surface of the stopper C, and beyond that under a projecting ledge H, formed in the solid part of the neck of the vessel, and the extremities G of the springs therefore are thus held by the projecting ledge, and are prevented from rising by their expanded state as shown in the figure, and thus the vessel is securely stopped. The stopper cannot be withdrawn until the extremi-

ties of the springs be released from their expanded position, which is effected by the application of a key to the springs. A key for this purpose is shown at figure 13; its arms are passed through holes made for that purpose in the plate E, and by this action of the key, the limbs F F of the springs are compressed until their extremities G G are released from the projecting ledges H H; the stopper may then be withdrawn. D is a smaller stopper, which is placed over the plate E, more completely to stop the mouth of the vessel.



The figure 14 represents a different construction and combination to effect the inviolability of bottles; this is effected by a peculiar construction of the vessel itself, and of its stopper, and by combinations operating to hold the vessel and its stopper securely together, and only to be separated, or the stopper be withdrawn, by the agency of a detached key.

Fig. 16 Fig. 15



A A represents a longitudinal section of the upper part of a bottle fitted with the stopper B, thus constructed:— C C is a cylindrical passage, formed centrically through its entire length, as shewn at figure 16; D D is a cylindrical collar of metal, in which a screwed hole is formed, as seen at figures 14, 15 and 16, for the purpose of receiving the male screw E, cut upon one part of the vertical rod F; the

upper part of this rod has a groove, G, formed through its entire length, commencing from the upper part of the screw B B, and H H a frustrum of a cone formed of glass, and connected to the lower extremity of the rod F by a nut and screw. I I are two curved pieces of glass, whose outer circumference, when they are in close contact with each other, (as shewn at figure 6,) forms an entire circle; the inner circumference is made to correspond with the circumference of the piece H, at the point *a* of its diameter, so that when they are in the position shewn at figure 15, they coincide with or assume the same curvature as the inside of the vessel, and on the outer side of the piece H, at their points of contact therewith, the said pieces (I I) are connected or hinged to the under side of the stopper B B by an elastic waterproof or other suitable substance attached to the stopper B B, and pieces I I, by a strong cement. It is evident that the second position of the pieces I I and H H, as described, then admits of the stopper being readily withdrawn.

The patentee claims, as of his invention, the construction and combinations of the apparatus and instruments as they are described, and the compound apparatus or instruments produced in the modifications described; and this as regards the improved forms of bottles and vessels of that character, with the improved modes of stopping the same; and also as regards the modes of withdrawing stoppers in the several varieties of construction and combination.

REGISTRATION OF DESIGNS FOR ARTICLES OF UTILITY.

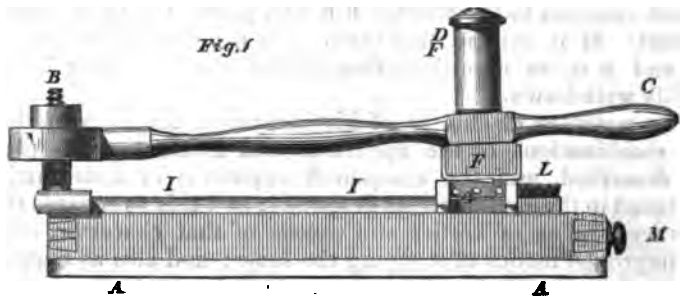
Pursuant to Act, 6 & 7 Vict. c. 65.

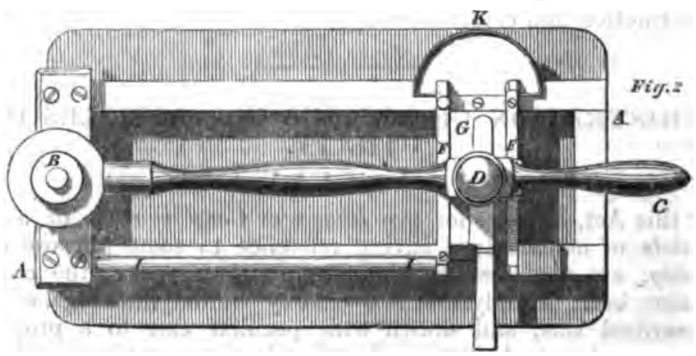
By this Act, Designs for the *Shape* or *Configuration* of any *Article* of manufacture having reference to some purpose of *utility*, are protected for the term of *three years;* the conditions being simply that two exactly similar drawings, of a prescribed size, and drawn with peculiar care to a proper geometrical scale, be delivered to the Registrar, with a written description, pointing out the particular novelty or improvement sought to be protected.

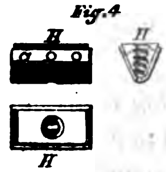
HALFPENNY'S *Machine for cleaning Knives and Forks.*

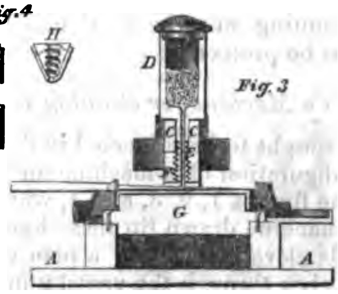
The design sought to be protected in this case, consists in the shape and configuration of a machine for the purpose stated—as shewn in the figures 1, 2, 3, and 4, which represent different views of the machine drawn (in these figures) to a small scale. Fig. 1. is a side elevation; fig. 2. a plan view; fig. 3. a transverse section taken through the vessel D in figs. 1 and 2. At fig.

4. are detached views of some of the parts, and having similar letters of reference placed on corresponding parts in all the figures: A A is a framing of wood or metal, at one end of which a screw B is secured in a vertical position, and is a fulcrum for the lever C to turn upon; D is a hollow vessel to contain brick-dust or other material of like character used to clean knives, &c., and which passes through a hole formed through the centre of the screw E, and in the direction of its length, as seen in fig. 3; F F is a piece of wood having a screwed hole at its centre connecting it to the screw E. This piece of wood is supported by a cross piece G fixed to the framing, as shewn in figures 2 and 3. Its upper surface is covered with chamois or buff leather, as well as the under surface of the piece F; this piece has a slot in the direction of its length to allow the









material to pass freely from the receptacle D. The figures 2 and 3 represent a knife placed upon the cross piece G. Now motion being given to the lever C, will distribute the material contained in the vessel D over the surface of the knife or other article to be cleaned; and the friction acting with the application of the material by the traversing motion of the handle has the effect of cleaning. For cleaning forks, a piece H is substituted for the piece F. The projecting piece I I, on the framing is likewise covered with chamois or buff leather, and is designed to be used for cleansing such parts of a knife, fork, or other like article as may not conveniently be operated upon by the other parts of the machine. K is a tray, L a brush, and M a drawer for the reception of the knives and forks. The proportions of the pieces F and G will, in practical construction, always depend upon the dimensions of the knife or article to be cleansed.

REVIEWS.

Geology, Introductory, Descriptive, and Practical. By DAVID THOMAS ANSTED, M.A., F.R.S., F.G.S., Fellow of Jesus College, Cambridge; Professor of Geology in King's College, London. Van Voorst. Nos. 1—6.

THE science of Geology is, without doubt, one of the most fascinating departments of human knowledge. Its objects are so vast, and so varied, while the speculations to which it has given birth, exercise a kind of spell over the imaginations of men. We are led back by it over periods of time, in comparison with which all our chonology is but as a moment; and it discloses to us, in the far depths of past existence, other orders of organized beings, which have left no trace saving their inanimate remains, in some instances entombed to a depth of miles beneath the present surface of the globe; or in their footsteps, which, although imprinted on so unstable a medium as sand, are nevertheless clearly and distinctly visible on many parts of the earth.

This last circumstance is, perhaps, one of the most interesting in the whole range of the science; and we shall never cease to remember the feelings with which we once beheld a slab of sandstone slowly raised from its deep bed, where it had remained for ages of ages undisturbed, having on its lower surface many beautiful models, in bas-relief, of what appeared, at first sight, to have been a human hand that had left its prints on a bed of clay, over which the sandstone had soon afterwards been deposited. These appearances had in reality been produced by the tread of a gigantic animal, whose real nature is only conjectured, notwithstanding all the ingenuity which has been exercised to ally it with some known tribe of organized beings.

These impressions exist chiefly in the new red sandstone, and have been found in several parts of Great Britain, in Saxony, and in the United States of America.

Mr. Ansted informs us that " those found in Europe consist partly of the footsteps of small animals, supposed to be tortoises or turtles, but contain also amongst them others belonging to a much larger animal, and differing entirely in shape and proportions from such as would be left by any known quadruped or reptile. The American specimens have been referred by Dr. Hitchcock to large birds.

" The larger foot marks impressed on the marly substances of the new red sandstone in Europe, bear a singular resemblance to the impression that would be made by the palm and expanded fingers and thumb of the human hand, and for that reason the name Chirotherium (χεὶρ, *a hand*, θηρὶον, *a beast*,) was proposed to designate the unknown animal by which they had been produced. The dimensions are various; but in all cases the prints of what appear to have been the hind feet, are considerably larger than those of the fore feet, so much so, indeed, that in one well preserved slab, containing several impressions, the former measures 8 inches by 5, and the latter not more than 4 inches by 3. In this specimen the print of the fore foot is not more than an inch and a half in advance of that of the hinder one, although the distance between two successive positions of the same foot, or the length of the pace of the animal, is 14 inches."

On some specimens we have seen distinct impressions of nails at the end of each toe, and a fringe of marks exactly as if the foot had been hairy. The animal appears to have varied greatly in magnitude, as the foot-prints present almost incredible differences in size; but we have yet no clue to its true position in the scale of beings, while Professor Owen's opinion of its being a Saurian reptile appears to us to be more than problematical.

The mysterious interest which envelopes the whole subject remains, for human ingenuity has not yet been able to dispel it. Such, however, is not the case with most other fossil appearances. And here it is hardly possible sufficiently to admire the extraordinary combinations of knowledge and skill which the labours of some of our greatest naturalists exhibit. The public know so little of comparative anatomy, that when they hear of a naturalist having been able, through its means, to build up an animal, and detail all its habits, and even its very food, from the inspection of a few teeth, or petrified bones, dug out of a quarry, they either turn away in incredulity, or look on in stupid wonder; because they will not take the trouble to investigate the beautiful facts and deductions by which a degree of moral certainty is arrived at on these points, sufficient to convince the judgment of all but the prejudiced.

Let us take as an example the determination of the Iguanodon, a gigantic reptile which once grazed among the swamps and forests of the weald. Some curious teeth were found in the south of England, and sent to Cuvier: he writes, "These teeth are unknown to me; they do not belong to a carnivorous animal, and yet they must, from various appearances, be reptilian; for although at first sight one might fancy they had belonged to a fish, yet their internal structure is completely different. May we not have here a new animal— a herbivorous reptile? And as among living terrestrial animals the herbivora are the largest, why should not the same have been the case among the reptiles in former times, so that when they were almost the only inhabitants of the land, the largest amongst them should be vegetable feeders? Time will prove or disprove the accuracy of this idea, for some portions of the skeleton and fragments of the jaw must ultimately be found."

Here we have a masterly sketch, such as none but Cuvier could have drawn. Fragments *were* found which fully bore out the description of the great naturalist, but did not add much to it: and subsequent inquiries have shewn that this anomalous, herb-eating reptile was a giant of its kind, whose dimensions are thus given by Professor Owen.

Length of head	3 feet.
Trunk and sacrum . . .	12 „
Tail	13 „
Total length . . .	28 feet.

"This view of its length," says Mr. Ansted, "gives but an imperfect idea of the real nature of the extraordinary monster whose remains we have been considering, for it is rather in its unusually massive proportions and anatomical structure, than in its length, that it really differs so widely from any known genus of reptilian animals."

The size of other primeval animals was, perhaps, even greater than that of the Iguanodon, while their whole structure appears to have been adapted to a widely different physical condition of the earth from what at present prevails.

The microscope has unveiled geological wonders, perhaps, even more interesting than those we have passed under review. Take, for instance, the following from Mr. Ansted's work. "A powder has been long known, and is used in the arts under the name of Tripoli. It is obtained from Bilin, in Bohemia, and a similar stone is also found at Planitz, near Zwickau, in Saxony, and in other places. It consists almost wholly of infusoria cases, perfectly preserved, and supposed by Mr. Ehrenberg to have been exposed to a very considerable heat, completely evaporating the carbon derived from the plants on which the animals lived, as well as the organic carbon of the animals themselves. A single druggist's shop in Berlin consumes yearly more than

20 cwt. of the polishing slate, and yet there seems a sufficient supply for purposes of practical utility, although a cubic inch, weighing 220 grains, contains upwards of forty thousand millions of individuals lying together, closely compressed, and without cavities, and also without any foreign cement." What an idea of prolific power is conveyed by the fact that a cubic inch of tripoli contains remains of forty times as many perfect organisms as there are human beings on the face of the earth!

In pursuing geological investigations, there is abundant occupation for the most varied powers of intellect. Indeed to be a geologist in the higher sense of the term, a man ought to have almost universal acquirements. Every department of science has to be brought to bear on the various and complex phenomena which are at times presented for investigation, and a deficiency in any one branch would in all probability vitiate the whole result. Fortunately, however, there are so many departments of the subject independent of each other, that any one who devotes his time to such pursuits is almost certain of an abundant reward. Time and means are essentially necessary; but how many are there with plenty of both on their hands, to whom geology would be a means of never-failing enjoyment, who, nevertheless, squander both in idleness or even worse? It is to such persons that elementary works on geology would be more particularly useful. Some of them are very attractive, and contain a great amount of important information. It is quite true that to be a geologist a person must do more than read elementary works, or indeed works of any kind: he must work with his own hands if he intends to arrive at eminence; and one of the most pleasing features of the geological literature of the present day is just that it exhibits the most untiring zeal in the acquisition of truth in the only way in which truth can ever be won, namely, by personal labour.

It exhibits in this respect a vast improvement, which to a considerable extent is due to the exertions of British geologists, who now deservedly rank above those of all other nations. Professor Ansted's work is a thoroughly practical one, and is evidently written by one well conversant with his subject. In the six numbers which have already appeared, he confines his attention chiefly to the geological structure and organic remains of the Palæozoic secondary and more recent formations. His arrangement is logical and his style lucid, and he communicates a great deal of information within a comparatively small compass. As an introductory work, in which organic remains occupy a prominent part, it is one of the best we have seen, and will doubtless prove useful in disseminating sound information and correct general principles. The first four chapters are devoted to necessary technical discussions. Five to the Older Palæozoic period, comprehending the Cumbrian, Cambrian, and Silurian formations with their fossils. The mid-

dle Palæozoic period, under which are described the old red sandstone and Devonian rocks, occupies four chapters, from which we shall extract an account of the Pterichthys, one of the most anomalous of fossil fishes, as a specimen of Mr. Ansted's descriptions.

"The appearance of the *Pterichthys* is sufficiently remarkable. The body is of considerable depth, the under part flat and the upper part rising into a kind of ridge along the back, but the whole covered with a strong armour of bony plates. These consist on the under side of five, the middle one being diamond-shaped; but on the upper side there are six principal plates on the body besides those which cover the head. All the plates are thickly tuberculated outside with wart-like prominences of enamel, and their internal structure is bony. The head is covered by one hexagonal plate (like the plates on the body) surrounded by several others of smaller dimensions, separated from the principal one by deep channels. The eyes are in front, and the mouth appears to have opened, as in many fishes, along the edge of the snout. The tail attached to this strange body, and the wing-like fins, from which the genus takes its name, are not less curious than the body itself. The fins are placed so far forwards, and are so large as to give a very disproportionate appearance to the body, and their shape adds to the strange effect; for they gradually swell in breadth from the point of their attachment, swelling out until they are somewhat suddenly rounded off, and terminating in a kind of hook or strong curved point. The tail occupies more than a third of the total length of the animal, and is straight, pointed, and covered with small tuberculated angular scales. It appears to have been supported by a continuation of the vertebral column, and rib-like processes stand out as if from the vertebræ, making an acute angle towards the extremity of the tail. Most probably the tail was employed as the principal organ of locomotion, the pointed fins being elevated at the approach of danger, and the animal in this way rendering itself as unapproachable and as difficult to be swallowed as its form would admit of."

We are indebted to Mr. Miller, a "working geologist" in the truest sense of the term, for our knowledge of the Pterichthys, which he discovered while working in the sandstone quarries on the shores of the Moray Frith. It differs from every other known animal, and is in fact a fish covered with the shell of a crustacean animal. It appears as if in those early times species were not so distinctly marked as they now are, as there existed certain connecting links in the scale of beings which have all disappeared, and are known only from their organic remains, which nevertheless prove them to have been possessed of certain structures not now found together in the same animal.

But to return. The Newer Palæozoic period, comprehending the carboniferous systems and the lower new red sandstone, with their fossils, are treated of in eight chapters; while sixteen are devoted to the secondary formations, and eight to the tertiary.

The last number of the work comprehends the superficial deposits and the primary rocks, and we are told that two other numbers will complete the work. The illustrations are numerous, well chosen, and generally pretty well executed, although the characters of the rocks in the small vignettes of scenery are rather obscured by shading. These characters are always given with most force by good bold outlines, unless they be engraved on a large scale, and finished at great expense.

We cannot conclude this brief notice without saying a few words expressive of our deep conviction of the growing necessity which exists for the spread of geological knowledge as an ordinary branch of education. Not only is this needful on account of the expanse of mind necessarily resulting from so extensive a knowledge as the science is now capable of communicating, but also from the numerous practical results which easily flow from such knowledge. What a world of trouble would an acquaintance with the geological structure of a country save to a farmer, especially to an emigrant farmer, who of all men requires to be possessed of the greatest variety of means of saving labour. We have known a vast expense incurred in searching for coal in localities where a slight acquaintance with the stratification would have convinced any one that no coal existed. The whole subject of Artesian wells, which is at present attracting so much attention, is based on a knowledge of the geological structure of the country. On this hangs success or failure in the operations. Such wells sunk in certain situations only can yield water, while in others, they would not only yield none, but would on the contrary act as drains to the soil; and this is a means of drainage which we yet hope to see carried out extensively.

It is almost superfluous to allude to the value of geological knowledge in mining, for it is well known that every miner must be a geologist.

Then, again, how intimately connected is this branch of knowledge with the whole science of topography, which is of so much importance in our colonial empire, although at present little attended to. Geology is one of the means whereby the best situations for future cities may be chosen; and without its application to such purposes, the whole questions of drainage or supply of water, or healthiness of position, have to be solved by hap-hazard alone. In a military point of view also, a knowledge of the structure of a country is of the highest importance in the choice of positions, whether for health, or

water, or strength; in short, in every profession which has aught to do with the surface of the earth, or with what is beneath the surface, geology is a science which can never safely be neglected.

The Complete Concordance to Shakspere, being a Verbal Index to all the Passages in the Dramatic Works of the Poet. By MRS. COWDEN CLARKE. London, Charles Knight, 1844. Parts I. II. III.

PEOPLE have long since ceased to speak of the Seven Wonders of the World;—in literature, science, and every department of art. Such marvellous achievements are now daily accomplished, that we no longer feel surprised at the execution of any task, however elaborate or extraordinary it may be. Time was when the industry of the great Lexicographer astonished the world; the time now exists when a life of labour may be devoted to a pains-taking task, and, after all, the result be not adequately appreciated. It would be idle and almost impertinent to dwell for an instant on the pleasure and instruction, and almost intuitive, or rather prophetic, knowledge conveyed by the works of Shakspere. He who would, even in the inward aspirations of his heart, desire only to approach such a shrine, must, as Sir Walter Scott observed, at the celebrated meeting at which he avowed himself to be the author of Waverley, hang up his crutches like the beggar at the portals of the temple, as symbolical of his weakness and inability to approach worthily the object of his adoration. To have then at hand a guide, a kind of silent friend, who can, as with a talisman, enable us at once to fasten upon any peculiar expression, thought, or sentiment, which Shakspere has recorded for all time and all nations, is to possess ourselves of a treasure, indispensable and almost invaluable to those who appreciate and are necessarily in the habit of referring constantly to his works. It is, albeit, in the shape of a royal octavo, placing a sort of familiar in our library, whom we must ever and anon be tempted to consult. Such is the character of the work before us, which aims at being a Complete Concordance to Shakspere. It might some years ago have been esteemed one of the literary wonders of the world, that a lady should have undertaken so laborious a task. We should require the Actuary at the National Debt Office to give us a statistical return of the number of sentences in every play, the number of lines in every sentence, and the number of words in every line, before we could even form an adequate idea of the trouble which such an undertaking must prospectively have entailed on its projector.

It is truly observed in the Prospectus, that the "achievement of a work, such as would combine every requisite of distinct

reference and completeness, demanded much time and labour, and, above all, much persevering enthusiasm, as it was a task, which, though in its spirit delightful, yet in its detail was fatiguing."—This must have been the case, for it appears that a period of more than twelve years has been devoted to its compilation. It will be remembered that Twiss's book is a mere dictionary without context; Ayscough's, which is entitled "An Index to the Remarkable Passages and Words made use of by Shakespeare," is, as the title indicates, a selection only, and the reader is frequently disappointed in finding particular passages he may wish to refer to. We have indeed compared the Index of Ayscough with the Concordance before us; and find that this Concordance to Shakspere is infinitely the most elaborate. It is a complete verbal Index to every passage, and will be found to agree with the Variorum, Payne's, Collier's, Charles Knight's, and all the acknowledged best editions. The compiler, Mrs. Cowden Clarke, a member of the talented Novello family, merits the thanks of the literary world for the production of a work of reference which must have cost so much labour, and which will undoubtedly prove exceedingly useful to all literary men.

THE PROGRESS OF SCIENCE.

(To be continued Monthly.)

ASTRONOMY.

New Comet.—M. Victor Mauvais, Member of the French Institute, and one of the astronomers of the observatory, has discovered a new comet. It was observed between the stars of Sigma and Tau, in the constellation of Hercules—the apparent diameter of the nebulosity being from three to four minutes of a degree, with a small brilliant nucleus. It was seen by Sir James South momentarily, and more distinctly by Mr. Main, at the Royal Observatory, Greenwich, on the 15th. The following are the particulars given by Mr. Main:—

"At 10h. 17m. mean solar time, its right ascension was 15d. 43m. 5s., and its declination north, 42d. 4m. 14s. It is very nearly circular, having an ill-defined planetary nucleus surrounded by a coma. Its brightness is considerable, and it may be easily found with a small telescope."

CHEMISTRY.

Artificial Production of Black Lead.—On demolishing the interior brickwork of the iron furnaces at Niederbronn (Lower Rhine), while the furnaces were still hot, a shower of sparks, or of charcoal dust, had sometimes been observed to escape from the crevasses. On examining whence the sparks proceeded, they were found to come from deposits of carbon

amongst the stones of the fabric. This carbon appears to have entered the finest fissures in a state of vapour, and to have been deposited either in amorphous fragments, or in balls, the centres of which were amorphous, while the outer parts were radiated, and the surface covered with stalagmitic tubercules. This matter has all the properties of plumbago. It burns completely away, leaving only a trace of oxide of iron. It must have arrived at its position in a gaseous state, and appears to explain the origin and formation of plumbago, which would hence appear to be nothing more than carbon sublimed from deposits of anthracite by heat arising from the proximity of igneous rocks.

DAGUERREOTYPE.

Modification of the Daguerreotype Process. — M. Fritzsche exhibited to the Academy silver cards, intended to replace the metallic plates at present in use along with a view procured on one of these cards. M. Lvitsky prepared these cards with Bristol board, which he covers with silver leaf, by means of white of egg and red chalk. They are polished with rouge and cotton. The card is employed in the same way as the metallic plate. Its edges are slightly waxed. The images may be fixed by a concentrated solution of hyposulphate of soda, and the card washed, without injury.

ELECTRICITY.

Transmission of the Electric Current.—On the 8th of August last, Mr. Morse having prepared a copper wire, 160 miles long, for an electric telegraph, which he was commissioned to construct for the American Government, made a number of experiments to test the accuracy of the law of M. Lenz. The wire was rolled in 80 coils, each 2 miles long, and the current, from a Grove's battery of 100 pairs, was transmitted through one or more of the coils, so as to obtain the effect of any given length of wire.

The current from the 100 pairs was first passed through the whole length of 160 miles, and the power was found sufficient to move the telegraphic lever with great force. Forty pairs were not found sufficient for the purpose.

The next set of experiments was made on the decomposition of water, with different lengths of wire, and the following table shews the result.

Battery of 100 pairs.	Inches of gas in the gauge per minute.
Battery without a length of wire	5.20
„ 1 mile of wire	3.85
„ 2 miles	2.62
„ 3 „	1.84
„ 4 „	1.20

Battery of 100 pairs.		Inches of gas in the gauge per minute.
Battery	5 miles of wire	1.05
„	6 „	0.92
„	7 „	0.80
„	8 „	0.71
„	9 „	0.64
„	10 „	0.57
„	20 „	0.30
„	30 „	0.20
„	40 „	0.14
„	50 „	0.094

ENERGIATYPE, A NEW PHOTOGRAPHIC PROCESS.

BY ROBERT HUNT.

While pursuing some investigations, with a view to determine the influence of the solar rays upon precipitation, I have been led to the discovery of a new photographic agent, which can be employed in the preparation of paper with a facility which no other sensitive process possesses. The following statement will at once show the exceeding simplicity of the discovery.

Good letter-paper is washed over with the following solution. A saturated solution of succinic acid two drachms, mucilage of gum-arabic half a drachm, water one drachm and a half. When the paper is dry, it is washed over once with an argentine solution, consisting of one drachm of nitrate of silver to one ounce of distilled water. The paper is allowed to dry in the dark, and it is fit for use. It can be preserved in a portfolio, and at any time employed in the camera. This paper is pure white, and retains its colour, which is a great advantage. At present I find it necessary to expose this prepared paper in the camera obscura for periods, varying with the quantity of sunshine, from two to eight minutes, although, from some results which I have obtained, I am satisfied that, by a nice adjustment of the proportions of the materials, a much shorter exposure will suffice. When the paper is removed from the camera, no trace of a picture is visible. We have then to mix together one drachm of a saturated solution of sulphate of iron, and two or three drachms of the mucilage of gum-arabic. A wide flat brush, saturated with this solution, is now swept over the face of the paper rapidly and evenly. In a few seconds the dormant images are seen to develope themselves, and with great rapidity a pleasing negative photographic picture is produced. The iron solution is to be washed off as soon as the best effect appears, this being done with a soft sponge and clean. The drawing is then soaked for a short time in water, and may be permanently fixed by being washed over with ammonia, or perhaps better with a solution of the hyposulphate of soda, care being taken that the salt is afterwards well washed out of the paper. From the pictures thus produced, any number of others,

correct in position, and in light and shadow, may be produced, by using the same succinated papers in the ordinary way, from five to ten minutes in sunshine producing the desired effect. The advantages which this process possesses over every other must be, I think, apparent. The papers are prepared in the most simple manner, and may be kept ready by the tourist until required for use. They require no preparation previous to their being placed in the camera, and they can be preserved until a convenient opportunity offers for bringing out the picture, which is done in the most simple manner, with a material which can be anywhere procured.

ETHNOLOGY.

A tract has been published by M. d'Omalius d'Halloy "*Sur les Races Humaines*," of which the following is the account given by the author when presenting it to the Academy of Sciences. He states that he had endeavoured to show, that in classing the modifications of the human race, the *natural characters*, such as form and colour, ought to take the precedence of language, historical filiation, and other *social* considerations. He then points out that the application of this principle leads him to remove the Hindoos and Abyssinians from the whites and to add them to the brown race, which thus becomes composed of three geographical groups, separated respectively by the Sea of Oman and the Gulf of Bengal. He concludes with remarking upon the constantly progressive development of the whiter varieties of the human race, whilst the coloured races, and also the least fair of the white race, are stationary or retrograde; whence it may be said, that notwithstanding the stability which now characterizes organic nature, there is yet in progress a phænomenon of a like kind with that which is revealed to us in the palæontological study of the terrestrial globe, which exhibits the successive appearance of species more and more perfect; fish having preceded reptiles, reptiles the didelphous mammalia, and these latter the monodelphous; man having come last, to crown the series.

GEOLOGY.

At the sitting of the French Academy of Sciences on the 3d instant, a letter was read from M. Felix Robert, which stated that he had found, in breaking a block of marly limestone near Alais, (25 miles N.W. of Nismes,) fossil bones which he recognised as those of man. There is a pretty large portion of a cranium where an apophysis is perceived, and teeth well characterized, as molar, incisive, and canine. The rock which contains them is a sedimentary bed about a metre (yard) in thickness, and of a yellowish colour. It rests upon other beds of a very compact limestone, of conchoidal fracture, in alternate

strata of black and white, and veined with carbonate of lime. Above the whole is a considerable deposit (*banc*) of rolled pebbles, or diluvium (*terrain de transport diluvien*). M. Robert added, that M. Marcel de Serres and several other geologists of Montpelier, to whom he had shown the bones, had agreed with him in recognising them as the teeth and a portion of the cranium of a man.

M. Moreau de Jonnes observed, that at the request of Cuvier, he had drawn up, twenty years ago, a detailed account of a similar discovery made in the Grande Terre district of Guadaloupe, and that the facts were not favourable to the idea that the fossil was antediluvian. M. Elie de Beaumont and Dufrenoy followed, and remarked that confidence could not be put in such accounts, for similar statements had been often made and never established.

THE ARTESIAN WELL AT NAPLES.—The boring has arrived at the depth of 108 yards. It has traversed sixty yards of yellow tufa; next it has pierced a gray tufa of much older date, and the marine formations and sands intermixed with thin layers of pumice, are beginning to appear. The temperature augments very slowly.

THE ARTESIAN WELL NEAR PARIS.—The volume of water supplied by the Artesian Well of Grenelle was measured a few days ago, and found to have lost nothing of its force or quantity. The source furnishes 2,000,000 quarts of water per 24 hours, which is more than sufficient for the consumption of the quarter of the Pantheon, where immense reservoirs have been constructed to receive it. The water is as limpid as filtered Seine water, and has continued clear since tubes have been inserted in the aperture.

FINE ARTS.

ART UNIONS.—THE NEW ACT OF PARLIAMENT.

THE evil tendency of Art Unions was the subject of an article in a late number of the London Polytechnic Magazine[*], the object of which was to demonstrate that these associations were not only illegal in principle, but that the operations of them would prove injurious to the interests of Art. It is probable that the mere point of law which has subsequently identified them as falling under the category of "lotteries, littlegoes, and unlawful games," never would have been mooted had the original objects of the London Art Union been only fairly dealt with. It is true that similar, or rather apparently analogous associations exist in Prussia, in Bavaria, in Wurtemburgh and other parts of the

[*] Vide the London Polytechnic Magazine. The evils of Art Unions. By an Artist, p. 332.

Continent; but in a busy commercial country like this, the principle of a chance distribution of works of art, was no sooner started than it was immediately extended and abused. One of the present sheriffs of London, himself an eminent printseller, could not refrain from standing *au clair de la Lune* by his own wheel of fortune. Thus did the London Art Union, by adopting an unhealthy lottery principle distribution of prizes, throw open the floodgate for those abuses which have necessarily called forth the interposition of government. There is no difference ethically between drawing a prize ticket at a picture lottery, and winning a little gold for the deposit of a little silver in the gambling booth on a racecourse. The speculators in each case make a small deposit for the purpose of winning a prize, the value of which may be much above the money risked. This as a matter of speculation is done, it is true, every day on the Stock Exchange, which may be fairly designated and stigmatized as the great gambling hell of Europe. Still Art, to the real lovers of Art, is for its own sake so much above even pecuniary compensation, that its higher works of genius ought never to be subjected to a chance principle of distribution. We do not affect to suppose that the artist, highly gifted as he may be, can be indifferent to the means, which money only can supply, of obtaining the comforts, if not luxuries of life. Yet no men, generally speaking, are so indifferent to worldly matters, at least in their earlier career of life. They leave their *studio* in this cold clime, and go southward full of hope and expectation, and often gifted with high inspiration; they wander through the south of France and the sunny land of Italy; they sojourn winters in Rome and communicate and sympathize with congenial spirits; or it may be that they pursue their rambles and survey the sea-girt isles of Greece and sometimes traverse the Atlantic and extend their romantic pilgrimages to the broad lakes and mighty rivers and cataracts of America, and when the spring of life, or it may be a portion of its summer has past, they return to this the metropolis, as we esteem it, of the world, and what do they then find? A government which does little or nothing for the cause of art; so supine, that it gives its sanction to Art Unions one day without looking into their real tendency, and then in a fit of extraordinary diplomatic dispatch pounces down upon them, proclaims their illegality and suppresses them on the very eve of a midsummer distribution of prizes. They find too, that this indifference on the part of government, prevails also among the aristocracy, whose patronage of art is rather nominal than real. The number of pictures purchased out of the Royal Academy exhibition during the last ten years by our English nobility has been inconceivably few. We have the meagre list of them, which we believe to be tolerably correct, before us, and are not surprised that artists should hail the field of Art Unions or any other mart, however fictitious,

for the disposal of their works. The Royal Academy itself does less for the encouragement of rising artists than for the support and interest of its own elect members, who annually reject pictures of high merit by younger aspirants to fame, while they themselves redecorate the walls of their own exhibition with their own pictures. There is not for young and rising artists in England at this moment any fair or open field; there is nothing to cheer, or encourage, or support them on their way. The very facts that the government authorities sanctioned in any way the existence of these picture lotteries, indicates an indifference to the interests of art. Their injurious tendency would have been manifest had the cause of art itself really been considered. This, however, was not the case. It is true that so large a sum as 36,000*l.* expended in seven years among poor artists, the poor artist and poor poet being proverbial objects of commiseration, must have dispensed good and possibly alleviated much individual want and suffering. Still, unkind or harsh as it may appear, the charity so administered must be held subordinate to the principle upon which art itself must seek to be supported. By a raffling picture booth much money may be raised and charitably applied; nay, it would be a boon to many poor artists, if from a fund so raised there were a demand for many hundred pictures at 10*l.* or 20*l.* each; but looking to the advancement of art, we do not want 10*l.* and 20*l.* pictures; but are content to pay a higher price for a higher class of works. The price of a thing may be just as much as it will bring, but artists ought not to be tempted to fritter away their talents and employ themselves like Peter Pindar's razor-seller in painting pictures merely to sell to Art Unions. It is the interest of artists to uphold the legitimate value of their works, and dispose of them not blindly upon a pitch and toss principle, but to those by whom art is really for its own sake appreciated. We cannot conceive any man of genius executing a high work of art for a picture lottery.

With these introductory remarks, we now lay before our readers the bill intituled "An Act for legalizing Art Unions." It consists, as will be seen, of two clauses only; the first giving a temporary protection to the associations now existing, which extends until the 1st of next January; the second provides that all such future associations shall be under the sanction or incorporation of a royal charter. The act is as follows:—

"Whereas certain voluntary associations have been and may hereafter be formed in various parts of the united kingdom, under the name of art unions, for the purchase of pictures and other works of art, to be afterwards allotted and distributed by chance, lot, or otherwise, among the several members, subscribers, or contributors constituting or forming part of such associations: and whereas such distributions of works of art, and the proceedings taken to carry the same into effect, may be

deemed and taken to come within the provisions of the several acts of parliament passed for the prevention of lotteries, littlegoes, and unlawful games, whereby the members of such art unions as aforesaid may be liable or subjected to certain pains and penalties imposed by law on persons concerned in lotteries, littlegoes, and unlawful games: and whereas it is expedient that all members, subscribers, contributors, and other persons belonging to such voluntary associations or art unions as aforesaid, or acting under their authority or direction, or on their behalf, shall be discharged and protected from any pains and penalties to which they may have rendered themselves liable by reason of any such purchases of pictures, or other works of art, and the distribution thereof: be it enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present parliament assembled, and by the authority of the same, that all such art unions, and all members, contributors, subscribers, or officers thereof, and persons acting for them or on their behalf, shall be discharged and freed from all suits and prosecutions, liabilities, pains, and penalties to which by law they might be liable, as being concerned in lotteries, littlegoes, or unlawful games, for any thing done or which may be done by them or any of them herebefore, or before the first day of January next, touching the purchase of any such or other works of art, or the sale or distribution thereof by chance or lot.

"And whereas the future establishment of such voluntary associations, if duly regulated, will lead to the encouragement and improvement of the fine arts; be it enacted, that all such voluntary associations as aforesaid, now constituted or which may be constituted hereafter, and all the members, contributors, subscribers, and officers thereof, shall be deemed to be lawful associations, and the members, contributors, subscribers, and officers thereof shall be freed and discharged from all pains and penalties enacted against parties concerned in illegal lotteries, littlegoes, or unlawful games, by reason of any acts or things done by them or any of them in furtherance of the purchase or distribution of such pictures or other works of art as aforesaid, provided that a royal charter or charters shall have been first obtained for the incorporation of such associations, or provided that the deed of partnership or other instrument constituting such associations, and the rules and regulations relating to such purchases and sales, shall have been first submitted to the consideration and approved of by the committee of her Majesty's most honourable privy council for trade and plantations, and a copy thereof deposited with such committee, and provided the purchase and distribution of such pictures or other works of art as aforesaid, shall have been conducted in strict conformity with the royal charter or charters which may have been granted, or the deed of partnership or other instrument constituting such

association, or the rules and regulations which may have been approved of, as hereinbefore set forth."

The first clause, it will be observed, simply grants an indemnity, or protection, to the several members, contributors, and subscribers, who are at present liable to certain pains and penalties for having entered into associations which fall under the law applicable to "lotteries, penny goes, and unlawful games." It was clearly "expedient," to use the words of the Act, that such contributors, subscribers, and members should be so discharged and protected, more especially as Prince Albert, the Queen Dowager, and some of the highest Law Officers, and Ministers of the Crowu, are found to have been unwittingly among the offending parties. It was, therefore, only right, in order that this act of the legislature might be made to "square to the universal fitness of things," that six months should be granted for the winding up of all such illegal proceedings. When law makers become law breakers, lenity is always expedient. The real moral of the tale is, that notwithstanding the recent much ado about nothing proceedings of the royal commission, the government does not give any thing like an adequate and sufficient encouragement to the fine arts. On the 1st, however, of next January, these Art Unions, instead of being, as the title of the Bill would imply, legalized—are abolished. Until then the wheel of fortune may go round. The second clause amounts equally to a prohibition of all such indiscriminate associations; for it is not to be supposed that the Board of Trade will recommend the grant of a royal charter for any such purpose without very deliberate consideration. It is very possible that Art Unions may be put upon a less objectionable footing than they are at present; but this remains a subject open for discussion. Hence, it is added that "this Act may be amended or repealed by any Act passed in the present Session."

MISCELLANEOUS INTELLIGENCE.

Extraordinary Meeting of the Geological Society of France.—This meeting will be held at Chambery, in Savoy, on the 12th of August. There are few localities which offer a larger variety of objects of interest than the environs of Chambery. There the modifications of the lias and the metamorphism of rocks can be studied in all their details. The Jura formation presents itself both in its proper characters and as it is changed by proximity to the Alps. Various tertiary groups also exist which are marked by local peculiarities, and the whole subject of erratic blocks and glacier motion may be investigated in the neighbourhood.

ELECTRO-MAGNETIC TELEGRAPH.

Description of Mr. Bain's Electro-Magnetic Printing Telegraph, now at work upon the South Western Railway.

In order to facilitate the description, we will divide it into three parts; considering, 1st. The magnetic apparatus. 2nd. The printing mechanism. 3rd. The compensating or correcting contrivance.

1st. The two wire coils are two electro-magnetic multipliers, in the form of hollow cylinders, wound round with wire: these coils form part of the galvanic circle, being connected with the conducting wire, which, proceeding from the plate of metal sunk in the ground somewhere near the machine, ascends by the left side of the stand, (right hand of the spectator,) and passing through a metallic screw under the board of the same, pierces this board, as well as that on which the machine rests, and is then connected with one of its four upright metal pillars. Along this pillar the electric current finds its way to one of the coils, from which a conducting wire carries it over the top of the instrument to the other coil, and thence it descends to the earth, where, protected by a coating of asphaltum, it proceeds along the line underground to the other machine at the distant station, and passing through that machine, exactly in the same manner as it does through this, terminates in the opposite plate of metal there sunk. The moisture of the earth conveys the electricity from one plate to another, and thus completes the galvanic circuit without the aid of a battery. The object of these wire coils is to accumulate a greater amount of electricity, in order to affect more powerfully the circular magnet, which is, in fact, composed of two semicircular magnets, the poles of which are within the coils.

The magnet is suspended by its diameter, which, for the purpose of facilitating the description, we will call the *magnetic needle*, referring to it all the motions of the magnet. This needle is fastened to the vertical spindle which revolves with it, and being acted upon by the electric current, it is now forced from its natural position, and *deflects* towards the stop connected with the metallic plate. As long as it continues in this position, the machinery will be at rest; but the instant the galvanic circle is broken, the needle, recovering its natural direction, will move towards the stop: the spindle turning consequently a little with it, will disengage from the notch or stop the small lever connected with the first train of wheel-work, and therefore this part of the mechanism, then free, will be put in motion by

means of the weight. Should the galvanic circle be re-established, the needle by being deflected, will impede the rotation of the lever by presenting to it the closed part of the notch, and the machine will stop. Let us now see in what manner the electric current may be broken or re-made at the will of the operator.

The dial is *isolated*, that is, that having no contact with the metallic parts of the mechanism, (which, as we have seen, are also in an electric state,) would be excluded from the galvanic circle, were it not for the artificial connexion which, with a double object, as we shall presently see, has been established between the dial and the rest of the machinery. This connexion is effected in two ways: the first is by means of the spring screwed at one end to the hand, which, being connected with the mechanism, is electrified, but has no contact with the dial revolving in a collar of wood, and resting with the the other on the small dial which forms a part of the large one. The second connexion is made by depressing the key in contact with the dial, and causing its point to touch the tube full of mercury and connected with the rest of the machine. By breaking either the one or the other of these connexions, the galvanic circle is broken also. The first connexion by means of the spring is employed in *both* machines when at full rest, and in the *passive* one, (namely, that which *receives* the message,) when they are at work; the second connexion by means of the key is employed when at work by the active machine, (that which *sends* the message,) in order to effect in both the momentary stoppages of the first train required for the printing of the figures.

Let us suppose that the operator at one of the telegraphs (the one at London, for example) wishes to transmit a communication to the other. He will first press with his finger the spring key, thus establishing the second connexion, and will then break the first by unscrewing the spring from the dial. As in this operation the electrical condition of the machine remains the same, no visible effect takes place; but as soon as he lets go the spring key and allows it to return to its present position, the galvanic circuit will be instantly broken, the magnetic needle will return to the stop, the small lever will be disengaged, and the first train being set in motion, the hand will consequently begin to travel round the dial. Let us suppose, also, that the communication to be transmitted is represented by the figures 37: when the hand is coming nearly opposite the figure 3, the operator will press the key, and, as we saw before, the first train will stop; but in so doing it will act upon the detent of the second, (in the manner hereafter explained,) this train will now begin to move, impelled by the weight, and the figure 3 will be printed on the paper which covers the cylinder. This done, the operator will again raise his finger from the spring key, the first train will again be put in motion,

and the hand, continuing its revolution, will reach figure 7: the first train stops as before, the second moves, figure 7 is printed on the cylinder, and afterwards, by the same process, the full stop which indicates that the communicated is ended: lastly, the hand will continue for the fourth time its revolution until it is completed and it returns to the starting point. If nothing more is to be said, the operator will again screw the spring in contact with the dial, when he may definitely let go the spring key, and the machine will remain in constant rest. Now, let the reader remember that whatever *this* machine has *shown* and *printed*, has been, at the same instant, *shown* and *printed* by the *other* machine at the farther station.

2. Let us now proceed to examine in what manner the printing is effected; this part of the mechanism requires close attention. There is a governor, similar to that employed in the steam engine to regulate its velocity: in the telegraph, however, it performs besides another most important office. When beginning to rotate, the balls diverge, and consequently the collar rises gradually up the shaft. There is a lever, so poised, that its lower extremity would tend to rise, yielding to the greater gravitation of the counterweight in the opposite arm, were it not prevented by the collar of the governor which presses upon it. The depression of the left arm of this lever causes the tongue and the rod, (both of which are fixed to the same axle as the lever, and at right angles with it,) to deviate from the vertical direction, and incline to the right. This inclination keeps the second train at rest; for the wheel and the fly, obeying the impulse given to them by the weight, would at once rotate, were it not that the first is prevented by the top of the tongue, and the second by one of the prongs of the fork; but suppose that on the balls of the governor beginning to rotate, the collar rise gradually; it is evident that as the friction wheel rises after it, the tongue and the rod will incline a little to their vertical position. The edge of the wheel, and the pin attached to the fly, will find a free passage, the latter between the prongs of the fork, and the former behind the tip of the tongue, and consequently the second train will begin to rotate. But the wheel has scarcely performed the twentieth part of its revolution, before the collar continuing to rise, and carrying after it the wheel, the tongue and the rod incline still more to the left, and the latter again impedes with the other prong of its fork the rotation of the fly, and consequently that of the wheel. The second train is therefore stopped, and remains at rest whilst the first is at work, and causes the hand to move on the dial. When the hand points to the figure which is to be printed, the first train is made to stop; the collar descends and presses down the wheel, and inclines again to the right; the pin once more finds a passage between the prongs of the latter, and the second train thus begins to move on the stoppage of

the first, in order to print the figure before which the hand was brought to rest. "But this movement," the reader perhaps thinks, "will cease as soon as the collar continues to descend, and the first train stops altogether." Such would be indeed the case, if a most ingenious contrivance did not prevent it. It will be observed that in the periphery of the wheel there is a groove, wherein, when the machine is at full rest, the tip of the tongue is inserted: during the momentary progress made by the second train, when the telegraph was first put in motion, the said tip entered within the periphery of the wheel, and the wheel, though little, progressed enough to place its groove out of the reach of the tip on its return. It is therefore evident, that when the first train afterwards stops, the collar cannot descend entirely to its point of rest, until the tip of the tongue re-enters the groove of the wheel; but this cannot now take place until the said wheel (at present free to rotate, inasmuch as the pin finds also a passage through the fork) shall have completed a revolution, and bringing the groove opposite the tip, will allow the latter to fall into it and regain its present position, in which case the fork will also resume its position, and the machine will stop. But during the revolution just mentioned of the wheel, the printing has been effected in the following manner.

The eccentric piece, called a *snail*, attached to the principal shaft of the second train, has performed one revolution, together with the wheel also attached to the same shaft. Now the arbor or shaft of the type wheel moves in its lower extremity upon a kind of pivot, which, without interfering with its rotatory motion, depending on the first train, and synchronous with that of the hand on the dial, allows of the wheel being moved bodily forward towards the cylinder, with which it would be kept in constant contact by the force which the strong spring exerts upon the moving plate to which the horizontal rods are attached, if the projecting part of the snail did not prevent it. However, when this projection of the snail, at a certain part of its revolution, escapes from the butt proceeding from the moving plate, the latter advances with a sudden jerk, (the spring being then allowed to act upon it,) pushing the type towards the cylinder, and as there is between them a ribbon saturated with ink on the side of the cylinder, the blow causes the figure of the type wheel, which happens to be opposite the cylinder, to be printed upon its surface; this figure is the same to which the hand is pointing on the dial. Meanwhile the snail, proceeding in its revolution, pushes back the butt, and stops ready for another impression, just when plates regain their present permanent position. At the moment when the type wheel comes in contact with the cylinder, a small hammer, by means of a simple mechanical connexion which it is unnecessary to explain here, strikes a

spiral spring, the sonorous vibration of which, similar to that of a church clock, gives information of the printing being effected.

The wheel concealed behind the wheel is connected with it in such a manner, that for each complete revolution of the former, the latter advances a given space, carrying with it the blackened ribbon, and this, by its mere pressure against the cylinder, causes it also to revolve proportionately in the direction of the arrow, thus presenting a new surface to the figure which follows the one already printed. The screw on which the cylinder moves, causes it likewise to ascend gradually as it turns, in order to make room for a fresh line: thus, if we suppose the cylinder covered all over with figures successively printed by the type wheel, they will appear in a continuous spiral line. The intelligence may, if required, be printed on a slip of paper introduced between the cylinder and the ribbon.

3. We have arrived to the third part of our description, namely, that which refers to the contrivance for correcting any error which may arise from the difference of speed in the two instruments. To understand it well, the reader must recollect, 1st, That the two machines, one at each end of the telegraphic line, are *exactly alike*. 2d, That the operator who transmits the intelligence moves, in doing so, not only *his own* machine but also the distant one; and 3d, That both perform, or ought to perform, *identical movements at the very instant of time*, so that both hands should pass simultaneously before the same figures in both instruments. It is at once evident that any discrepancy in the movement of the hands, without the means of discovering and correcting it instantaneously, would be fatal to the practical utility of the telegraph, in fact would render it even worse than useless, since the second machine would show and print a number different to the one indicated by the first. The contrivance by which this has been obviated is as admirable as it is efficient. We said, in part first, that there are two means of making and breaking the electric current; first, by means of the spring; and second, by the spring key. By perusing once more what we then said, the reader will remember that the machine which *sends* the message, employs the second connexion, whilst in that which *receives* it, the first will naturally be in use. Let us suppose that the machine which we have before us is the latter. The point or lower end of the spring on the hand travelling round the dial, will raze the edge of the small dial. This edge is divided in alternate compartments of metal and wood, the first *electric* and the second non-electric. Opposite each figure is a metal compartment, and a wooden one facing the intervening space, the latter somewhat larger than the former: the relative size between these compartments is preserved uniformly all round the edge, except in one place, to the left of the resting point, where we observe a wooden compartment

considerably larger than any of the others. The passage of the spring over these alternate spaces in the *passive* machine, does not affect the working of either, whilst the current of electricity continues broken by the *active*, but as soon as the key is depressed in the latter, and the electric circuit is re-established, the contrivance above alluded to will come into play. If in the act of the operator pressing the key in the first machine, the point of the spring in the second happens to be upon one of the *wooden* divisions, these being non-electric, the galvanic circuit will not be *immediately* re-established, and both machines will continue to go until the spring in the *second* comes in contact with the next metal compartment, when both machines will stop. Hence it follows that the second machine, which hitherto has been the *passive* one, becomes now the active, and controls the stoppage of the first, thus giving such information of its own movements and present state as enables the operator at the first machine to discover if both are going right, and correct in his own any discrepancy which may exist. The index or hand of the second machine, we have seen, can only stop *directly* opposite a figure, but this is not the case with the first, wherein the hand has no connexion with the dial whilst working; the stoppage of both instruments must therefore proceed from the *second*. Suppose, then, that in this, the hand stops before figure 3. If the first machine has lost with respect to the other, its hand will stop a little *before* 3, and, if it has gained, it will stop a little *after*. Now the operator at the first machine knows that the index of the other *must be exactly at* 3, and therefore he can easily correct his own by putting it a little forward or backward. But the discrepancy might perhaps amount to the whole distance from one figure to another, so that the second index might be at 3 and the first exactly at 2 or 4; in which case the mistake could not be discovered: but this contingency has also been provided against. We said, in part first, that after each communication is completed, the hand must return to the point of rest; to do this it must pass over the wide wooden space. If both hands go alike, they will pass it and stop at the same time, but if we suppose, for instance, that the index of the second machine is at 9, when that of the first is at 0, it is evident that the former will come to another metal compartment, and will stop both machines before the other has cleared the wooden compartment, causing it to stop in the middle of it. The operator at once sees that the machines are wrong, but yet he does not know exactly *where* the index of the second is. To ascertain this, he will set them both going, and stop them afterwards at every figure: when he finds that they will not stop until his own index has passed clear over two figures, he knows at once that the index of the second machine *is then crossing the wide wooden space*, and will stop at the resting

point. He therefore will bring his own index to it, perfectly certain of the error being rectified. On the other side, the operator at the second machine, seeing the index coming to its final rest, without printing the full stop, concludes that something is wrong, and watches for the signal agreed on in such cases, namely, two points printed in succession, which means that the previous communication is nul, and the operation is to be repeated. It is scarcely possible to conceive any thing more ingenious and beautiful than this arrangement.

The stand, or table, which supports the telegraph is four feet six inches high, but the height of the whole machine itself, including even the board which carries the levelling screws, is only eighteen inches. This is, indeed, *multum in parvo.*

We have seen that in this telegraph the electricity is not employed as a *working* power, but merely as a *regulator* to stop or let off the machinery; one of the many advantages of this plan over others now in use is, that the machine itself gives instant warning of any accident which may have happened to the conducting wire. Should this, for instance, break in any part of the line, the instruments at both ends would immediately go off without the possibility of stopping them by the ordinary means. This would plainly indicate what had occurred, and parties might be sent off simultaneously from both stations to detect the point of fracture. Now as in using the electric current of the earth instead of the galvanic battery, only *one* conducting wire is requisite, the process of detection, is, of course, greatly simplified; but even this remaining difficulty Mr. Bain has almost entirely removed by a most ingenious contrivance, which will not only indicate within a very short distance, the spot at which the fracture has occurred, but will also enable the telegraphic service to be carried on during the period of repair. However, as this new improvement has not yet been published by the inventor, we do not consider ourselves at liberty to enter into any further description of it.

Were it not foreign to the immediate purpose of this paper, we might add, that Mr. Bain is at present engaged in perfecting other inventions, if possible, more admirable still than the one just described, and certainly of a more universal application, having hitherto been entirely successful in his experiments. This, together with the triumph achieved in the masterpiece of mechanism now before us, would induce one to believe that however vast the field of practical applications which the recent discoveries in electricity have opened to the world, no end which can be attained by electro-mechanical means is beyond the reach of true creative genius.

PROJECTILE WEAPONS OF WAR AND EXPLOSIVE COMPOUNDS.

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The intellectual qualifications which raise man far above all other animals, have never been more industriously exercised than in perfecting the art of war; so that whilst the lion and the tiger are still obliged to meet their enemies at close quarters, and savages by their rude missiles scarcely gain a point in civilization, we, of more refinement, bring to the conflict every accessory of modern science, and kill our foes according to the most approved laws of mathematics and chemistry. The Utopian may shrink from the contemplation of so painful a subject; the moralist may raise his voice against the justice of war; but the practical philosopher can see but very little chance of its cessation, and actuated by the very best intentions, will endeavour to render warfare as terrible as possible, well knowing that so soon as certain death awaits two rival armies, princes must fight their own battles, or wars must cease.

Amongst the many improvements in the art of war, those relating to missile weapons, by which men are slaughtered at a distance, afford the greatest scope for scientific investigation, and are of the greatest interest to general readers. This interest, too, has lately been enhanced by the result of certain experiments tried by Captain Warner; experiments which have led many persons to suppose that some new means of urging projectiles has been discovered, and also some new explosive compound.

Such being the state of public feeling on this interesting subject, we propose giving an account of military projectiles in general, and especially those which are urged by the ignition of explosive compounds.

It would be impossible justly to appreciate the value of explosive compounds, in their particular application to the launching of projectiles, without devoting some attention to the means and appliances generally had recourse to anterior to the period of their introduction. We intend, therefore, to give a slight sketch of the nature and uses of missile weapons, commencing with remote periods and continued to the present time. As much as possible we will be restrained within the limits which bound the immediate subject, but occasionally those limits will be found not very definite, and we shall be obliged to merge into general history, to speculate on the moral consequences of improved systems of war, to notice varieties of defensive as well as offensive arms, to describe occasionally the manufacture of warlike implements, more particularly those to which present interest is attached, such as the Congreve rocket and percussion shell:—all this, and much more, of interest lies so near our

prescribed bounds, that we shall not hesitate to avail ourselves of it, merely because the title of our dissertation may be slightly violated thereby.

Man's first rude attempts at missile weapons were doubtless limited to the throwing of sticks and stones, by the mere aid of his hands; acts in which the monkey, the bear, and even the seal, are very successful emulators. A desire of more successful aggression doubtless soon suggested to man the use of projectiles more efficient than these. By a very slight change of form, the simple stick would become a javelin, capable of being hurled with great force and precision. An aid would suggest itself for casting a stone by means of a fillet or band, subsequently denominated the sling. Lastly, as involving a little more of mechanical contrivance, would be invented the bow; which in process of time, by subsequent additions, would become the arbalest or cross-bow.

By the time portable weapons would have been brought to the perfection just indicated, man's increasing sciences and civilization would have led him to build cities and inclose them with walls. Now would arise a necessity for other projectiles of greater force, inasmuch as in the event of war these walls would have to be demolished. The transition from portable projectiles to those of a heavier class was obvious enough; enormous javelins and darts were hurled by cross-bows of corresponding size, termed catapultæ; and engines, having the sling for their model, and hurling enormous stones, were termed ballistæ.

This appears to be the proper distinction between the two terms, although, by many persons, they are spoken of as synonymous. A variety of warlike missile engines were in use besides these, and called by the most fanciful names; however, the ballista and catapult may be considered as the types of all the rest: except indeed those which were adapted to particular localities or extraordinary occasions, when the number and variety of engines were only limited by the engineer's constructive skill.

In the prosecution of our subject, we shall first describe the various portable missive weapons which have been used in different nations, and then direct our attention to those of a larger class, such as would *now* be denominated *artillery*, a word, by the way, which originally signified *archery*.

The first missive weapon we shall notice in detail is the javelin or dart, variously modified, and known under several names.

The ancients were well acquainted with this weapon. In the Scriptures we have frequent notice of it, and every one is aware how extensive was its employment by Homer's heroes. In order to perfect the practice of this weapon, the ancients instituted javelin matches, constituting a part of what the Ro-

mans called their "jaculations." According to Plato [a], there were two sorts of jaculations; the first he called τοξειαν, and the latter ακοντισμα; the Latins translated the first word by "sagittatio," and the second by "jaculitio." Only the latter would appear to refer to the throwing of javelins, the former term having reference to the action of a bow. It would appear that the javelin used on horseback was about five feet and a half long, and that the steel with which it was headed was usually three-sided, but sometimes round. In order to launch it with greater force, it was not propelled by the unaided arm, but by the assistance of a thong fastened to its butt end.

Such was the javelin employed by the Greeks and Romans on horseback, and for the most part in their games; but the Roman infantry possessed a much more efficient weapon of the javelin kind, termed *pilum*. Of these weapons every man of the legionary soldiers carried two, which he hurled against his enemy in the charge. Polybius mentions that the point of this weapon being very long and small, was usually so bent at the first discharge as to be rendered useless afterwards. This was not an imperfection, but a necessary quality, lest the enemy might use it in their turn. Accordingly, we find that Marius was considered to have greatly improved this instrument, when, during the Cimbrian war, he so fashioned it, that on striking the enemy's shield, it bent down at an angle in the part where the wood and iron were joined, thus becoming totally useless to the party who received it.

With every improvement that the javelin was susceptible of, it never could acquire a long range; consequently we find that as archery became developed, the use of this weapon declined. Even at the present time, however, the javelin termed "*djereed*," is used with considerable effect by certain oriental nations, who invariably employ it on horseback. It is totally unadapted, however, to the nature of regular combinations and systematic attack.

Amongst savage nations the use of the javelin is very common; but the aborigines of Australia have a manner of throwing it altogether peculiar to themselves,—not grasping it in the middle, and throwing it whilst poised at a balance, but projecting it by means of a stick applied to the butt end. This contrivance accomplishes a great increase of range, but does not contribute to the accuracy of direction. Compared with such missive weapons as we are now in the habit of using, the javelin does not appear a very efficient weapon; yet at short distances its penetrating force is considerable, as is learned from the act of harpooning a whale;—harpoons being merely javelins thrown by hand.

These few remarks will suffice for the javelin, and we shall

[a] De Leg. l. viii.

now proceed to treat of another very celebrated missive weapon of antiquity;—the sling.

The force with which a stone can be thrown by the unaided hand, is altogether insignificant in a military point of view; several mechanical contrivances suggest themselves, however, for increasing the effect. Amongst the most simple of these is a fillet of leather or similar substance, broad in the middle, and tapering away towards either end. This is the common sling, which was used in the following manner. A stone or bullet being placed on the broad middle part, the two ends were grasped in the right hand: then the stone being whirled violently around the head, and one end suddenly slipped, the stone flies towards an object with great velocity. The islands Majorca, Minorca, and Ivica were, it is well known, called the Balearic Isles, on account of the expertness to which their inhabitants had attained in the use of this weapon. This dexterity they acquired by constant practice, being trained to it from their infancy; their mothers placing their daily food on the top of a pole, and giving them no more than they beat down with stones from their slings. This art is in some measure preserved by the Minorquin shepherds at the present day. The Romans had slingers in their armies, for the most part inhabitants of these islands. Diodorus Siculus says that they always carried three slings, one of which they held in their hands, another being tied round their middle, and a third round their head. Such was the violence with which, in battle, they projected their missiles, that the latter seemed as though they were cast by some military engine, and no armour could resist their stroke. In besieging a town, they wounded and drove the garrison from the walls, throwing with such exactness as rarely to miss their mark.

Slings never appear to have been much used by the English, although Froissart[a] mentions an instance of their having been used *for them* by the people of Brittany, in a battle fought in that province during the reign of Philip de Valois, between the troops of Walter de Mauni, an English knight, and Louis d'Espagne, who commanded six thousand men, in behalf of Charles de Blois, then competitor with the Earl of Montfort for the duchy of Brittany. Froissart says, that what made Louis lose the battle was, that during the engagement the country people came unexpectedly and assaulted his army with bullets and slings. According to the same author, they were also used in naval combats. Slings were used in 1572, at the siege of Sancerre, by the Huguenots, in order to save their powder. D'Aubigné, who reports this fact, says they were thence called Sancerre harquebuses. With respect to the range of this projectile, it is said that a good slinger would

[a] Vol. I. Chap. lxxxv. p. 304.

project a stone 600 yards; this assertion, however, seems very doubtful.

The bow. This weapon, under some shape or other, was employed by most nations of antiquity, but not always as a warlike instrument. Scarcely any two nations have made their bows exactly alike. The Scythian bow, we are told, was very much curved, as are the Turkish, Persian, and Chinese bows, at the present day; whilst the celebrated weapon of our ancestors, when unstrung, was nearly straight. All these bows, however, belong to the same class, being bent and discharged by the hand alone, without the aid of machinery. In process of time a modification of the bow was invented: in place of the original instrument, a much shorter and stiffer bow, usually of steel, was placed transversely in a stock, bent by a lever, and discharged by a trigger, after the manner of a gun. Bows of the former type were called long bows, whereas the latter were denominated cross bows.

It is not our intention to give an elaborate history of the bow, nor attempt to give the many varieties which antiquarian research has disclosed. We shall, therefore, do little more than allude to the bows and archery of ancient times and distant nations, and devote the chief of our attention to the developement of this instrument in our own land. We frequently read of the bow in Scripture; the first passage in which the use of the bow is inferred, is Genesis xxi. 20, where it is said of Ishmael, "and God was with the lad, and he grew, and dwelt in the wilderness, and became an archer." The overthrow of Saul was particularly owing to the Philistine archers, (1 Sam. xxxi. 3.) David, too, who succeeded him, bade them teach the children of Judah the use of the bow: "behold it is written in the book of Jasher," 2 Sam. i. 18.

The Greeks ascribed the invention of the bow to Apollo, by whom its use was communicated to the inhabitants of Crete; hence, in latter ages, the Cretan archers were thought superior to all others. Some, however, ascribed the invention to Perses, son of Perseus; others to Scythes, the son of Jupiter, the progenitor of the Scythians: all these tales show the antiquity of the instrument[a].

The Grecian bows were usually made of wood, but sometimes of horn, and frequently in either case beautifully ornamented with gold and silver; the string was generally made of horse hair, but sometimes of twisted hide, as we read of in Homer, whence the appellation τοξαβοεια. That part of the bow to which the string was fastened, the upper part, was called κορωνη, being commonly made of gold, and was the last thing towards finishing the bow.

The bow was not drawn in the same way by every nation.

[a] See Potter's Arch. Græc.

The ancient Persians[a] drew the string towards their ear, as is the practice still with the English. The ancient Greeks, however, drew the bow-string towards the breast, and represented the fabled Amazons as doing the same. Every one is conversant with the tradition of these people cutting off the right breast in order to give facility to drawing the bow.

Until the second Punic war the Romans had no archers in their armies, except those which came with their auxiliary forces[b]. Subsequently bows and arrows were more employed by this people, although, so far as we can learn, not by native troops; but by orientals in their pay.

During the reign of Clovis, who died 514, the French in their armies made no use of the bow, but it was employed during the reign of Charlemagne, who flourished in the beginning of the 8th century. This is undoubted, as, in an article of the Capitularies of that king, a count is mentioned who was directed, on conducting soldiers to the army, to see they had their proper arms, that is, a lance, a buckler, a bow, two strings, and twelve arrows[c].

We shall not trace the progress of foreign archery any further; but come to the consideration of our own.

It is certain that both Anglo-Saxons and Danes were well acquainted with the use of the bow, an art which they derived, without doubt, from Scandinavia. In the account of the games of the heroes of that country, given by the Scalds, or Scandinavian poets, archery is frequently mentioned. It would appear, however, that both Anglo-Saxons and Danes used the bow rather as an instrument of amusement or the chase, than a warlike weapon: and for its latter application we are indebted to the conquests of the Normans. In an ancient manuscript[d] of the 10th century, there is represented a Saxon bow, from which it appears that its construction was not at all adapted to render it a military weapon, the string not being fastened to the extremities, but suffered to play at some distance from them. Moreover, its size was altogether that of a mere toy[e]. There is very little doubt that the bow, as a military weapon, was introduced by the Normans at the battle of Hastings; we know that Harold was shot by an arrow; no mention, however, is made of archers on the side of the Saxons.

Although we know that archers tended very materially to secure to the Normans this memorable battle, it is not yet determined whether they used the long bow or the arbalest, otherwise called cross bow. Grose, in his Military Antiquities, states the former; general testimony, however, is in favour of the latter, and there seems collateral evidence to the same effect. We find

[a] Procopius de bello Persico, C.
[b] Potter, ut suprà.
[c] P. Daniel.
[d] MS. Cott. Claud. B. IV.
[e] Strutt's Sports and Pastimes, p. 39.

that the English, at subsequent periods, greatly preferred the use of the long bow, so that it was considered as a national weapon; while the cross bow was much more employed in France. Now we may easily fancy the English gradually perfecting the old Saxon instrument, and developing from it the long bow, when they would be disinclined to use a weapon introduced by the Normans, against whom there long remained an unconquerable aversion.

The exact time when shooting with the long bow commenced is uncertain, but its use was much extended about 1139, owing to a curious circumstance. The second Lateran Council[a] forbade, under the penalty of an anathema, the use of the arbalest or cross bow, as hateful to God, and unfit to be employed among Christians. Pope Innocent III. confirmed this prohibition. The reason of this strange decree seems to be the dangerous and painful wounds caused by this weapon; but it would require the united genius of many popes to discover agreeable methods of putting soldiers *hors de combat*. This prohibition was observed under the reign of Louis the young, and in the beginning of that of Philipe Auguste, but afterwards no regard was paid to it, neither in France nor in England. Richard I., despite Innocent's injunctions, introduced the cross bow into our armies, and being subsequently killed by an arrow shot from one of them at the siege of the castle of Chaluz, in Normandy, his death was considered as a judgment from heaven, inflicted on him for his impiety. Notwithstanding this example, the cross bow still continued to be much used by English troops, and in the list of the forces raised by Edward II. against the Scots, crossbow-men are enumerated.

(To be continued.)

LOPPODEN ISLANDS.

DESCRIPTION OF THE LOPPODEN ISLANDS, THEIR CURRENTS, AND THE CELEBRATED MAHLSTRÖM OR WHIRLPOOL.

By J. R. Crowe, Esq., H.M. Consul General for Norway.

The Loppodens are a remarkable range of islands, lining a portion of the coast of Norway, from north latitude 67° 20′ to 69° 20′, occupying about 4° of longitude; they are thus about 200 English miles in length, stretching from the s.w. to the n.e.; their greatest breadth is in the northernmost part, where they approach nearest the main, and from thence they stretch to the s.w. into the ocean, tapering off as they go south, until, at the south-westernmost extremity of Röst, they dwindle

[a] Artem illam mortiferam et Deo odibilem ballistariorum et saggitariorum, adversus Christianos et Catholicos exerceri de cætero sub anathemate prohibemus. Can. 29.

into a few low rocks; they rise in altitude in a similar degree, beginning at the water's edge at Röst and continuing to ascend until about the centre, where, as well as the northern range, they attain to an height of between 3000 and 4000 feet. The Loppodens comprise a considerable number of islands, some of considerable magnitude, such as Væröe, Moskenöe, Flagstadöe, East and West Vaagen and Hindoe, which are all more or less abrupt, precipitous, and of irregular forms, besides innumerable smaller islands, rocks, and holms; collectively they form the outer or western side of the west fiord, in which the extensive annual cod fishery is carried on. This fiord, which is by far the most extensive on the coast of Norway, has a communication with the ocean, independent of its 60 miles broad entrance, by numerous narrow sounds, through which the ocean receives and supplies the immense mass of water, which, with the ebb and flood, flows in and out of the west fiord, and the lateral fiords which intersect the main: between these narrow sounds the tide naturally runs stronger than in the broader fiords.

At the Mählström the tide is strongest; between Væröe and Röst the weakest.

The greatest rate of the tide in winter does not exceed six miles an hour.

In the west fiord itself there is no certain or regular current: there is an ebb and flow, accelerated by the prevailing winds, at times, in the fiord, when scarcely any current is perceptible; along the Loppodens and under the main, it will shift regularly with the ebb and flood, but what current there may be, sits always in opposite directions on each side of the coast, but when and where the shifting takes place, either on the Loppoden coast or the main, is uncertain, and not unfrequently dependent on the winds.

The depth of water is so considerable, that there are but few places the lead will reach the bottom, which are called by the fishermen Egger, and the depth on these varies from 80 to 200 fathoms.

Röst, which is the south-westernmost extremity of the Loppodens, is situated about 60 miles from the main, and is composed of a group of islands; the centre one is a large, low, flat island, and is the only one inhabited; it is surrounded by a number of rocks and holms, which, like Röst itself, sink below the horizon at a distance of about eight miles. A little to the south of the inhabited part, or home land, as the inhabitants call that island, are two high precipitous rocks called Storöe or Storfield and Vedöe, the first is 900 feet, the latter 750 feet high; a third, lying to the N.E., rises to an height of between 400 and 500 feet: these three islands, in clear weather, may be seen at a distance of about 30 miles, and present then certain land-marks to the navigator. There are several good harbours

in Röst, but they cannot be taken without a pilot; there is likewise a church on the centre island. To the s. and s.w. of Röst an uneven bank stretches itself for several miles seawards, which in various places elevates itself to shoals, on which the sea always breaks in stormy weather; in consequence of these, and the uncertain current that prevails, vessels, unless bound to the island, do not approach too near.

Around Röst the tide flows from every point of the compass in the twelve hours; with the flood it sets from the s.w. from the Loppod point through the Mosken stream, along Væröe and Röst; as the water falls more and more, the tide goes round gradually to the N.W., so that at half ebb, it runs due north between Röst and Væröe; with three quarters ebb it takes a more easterly direction, until it gradually slackens between Röst and Væröe. In the Mosken stream it remains still for half an hour, after which it begins with increasing rapidity.

At low water, when the tide under the Loppoden has commenced running to the eastward, it remains quite still at Röst for half an hour, when, as the water begins to flow, it takes a N.N.E. and E.N.E. direction from the north point of Röst towards Væröe; in the same degree as the water rises its velocity increases, and it gradually diverges to E. and S.E., until towards the flood it has again acquired a s.w. and s.w. s.s.w. course until high water, when it remains quiet again for half an hour. This is the usual course of the tides in fine weather.

In winter, when the weather is boisterous, and often continued westerly and north westerly storms, the current remains quiet during the whole of the time it, in its usual course, would have been flowing to the W.S.W. and S.S.E., so that at quarter ebb it is perceptible that it has a N.W. course; it then increases in velocity, taking a N. and N.E. direction, until it gradually slackens, and at half ebb again remains still. When the moon is on the increase, the tide runs stronger to the east than to the west, so much so, that its westerly course will not have had the velocity of its eastern. When the moon is on the decline it is the reverse.

Around Væröe, with full moon, it is high water at 12 o'clock. The difference between the highest and lowest water at full moon is 9½ feet, with new moon 6 feet.

Væröe, the next island to Röst, is likewise surrounded by shoals, holms, and rocks, so that to approach near to it is dangerous. The north-west side is quite inaccessible, and being uninhabited, assistance can in no case be obtained. On the eastern side there is a good harbour, and vessels not unfrequently take shelter in it. The island is rugged in the extreme, presenting bold and precipitous rocks on all sides, and rising in some instances to upwards of 1500 feet above the level of the sea. It is about 21 miles in circumference. This island is inhabited, contains a church, and is the residence of a clergy-

man. Barley will frequently ripen. Potatoes are cultivated, and the pasture in the valleys is both abundant and rich; the chief support, however, of the inhabitants, is the fishery. The currents here are similar to those around Röst.

The next island is Mosken, between which and Loppod point on Möskenoë is the far-famed and fabulous Mahlström, or whirlpool. The Loppod, or Möskenoë, is an island of considerable extent, being at least 70 miles in length and about 20 in breadth. On the eastern side it is thickly populated, and contains numerous good harbours; on the western side it is like Væröe, almost inaccessible; its appearance is abrupt and precipitous, rising in some places to an height of about 2000 feet. The current on the outer or sea side has a continual northern course, quite independent of the ebb or floods. The Mosken stream, or whirlpool, is greatly dependent on the wind and weather. With a westerly wind storm the current in winter runs occasionally constantly to the eastward, both with the ebb and flood; with highest and lowest water it slackens for a short time, and then resumes its eastern direction. If the sea gets up or increases in roughness, the velocity of the current increases in an extraordinary degree, and the Sound becomes unnavigable.

It frequently happens in winter, with westerly winds and storms, there will be a thick fog bank at sea, with a heavy sea rolling in, while on the opposite side of the west fiord and over the main it will be quite clear, which is a sure sign that there is a strong south-east wind falling out of the fiords, which will fall as a steady east wind out of the west fiord. Under these circumstances, the Mosken stream becomes dangerous, as the strong current, with the two opposite ground seas or under swells, combining, cause the sea to break throughout the whole length of the channel. The stronger the current runs the heavier the sea will be, and the eddies that are created become more irregular: no vessel then attempts to take the channel or stream. It is thus, in winter in stormy weather, and even in summer in strong gales, not prudent to go through the channel; but with a leading steady wind, or after several days' fine weather, there is no danger in passing through.

There is only one shoal, with seven to eight fathoms water on it, which may generally be distinguished even in calm weather; for although the sea does not break on it, there is always a kind of frothy ripple, different to that in the remaining part of the stream. To avoid this shoal, it is only necessary to keep closer to the Loppod point. To force your way in or out against the stream would not be prudent, as the wind, in order to make any head, must be so strong that a heavy sea is sure to arise, which at all times makes the channel difficult.

The stream runs strongest between Ud and Hogholm, but more violently under the Loppod point than under the holms;

to this may be added, that in many places the current sets right across towards the land; for example, where it meets along the shore the back water or contra current, which frequently runs as rapidly as the main stream, it acquires that direction.

The above brief description comprehends all the danger which the much-dreaded Mahlström presents. I have merely to add, that so little is thought of it by the inhabitants, that it is not unfrequently that the frail vessels of the country pass and repass at all states of the tide, except in the winter season, under the circumstances I have described. Small boats, with only two to three men in them, fish in the very middle of the stream, and cross from one island to the other, without apprehending any danger, nor have I heard of any one ever having been cast away. Far from its drawing in whales, or other fish that come within its influence, it appears to be a favourite resort of most of the fish peculiar to the country, and the fishermen generally reap a rich harvest from its bosom.

The outer or western side of the Loppodens in appearance is most forbidding and sterile in the extreme, presenting everywhere bold, precipitous and rugged sides, jagged and peaked summits, with scarcely a vestige of vegetation to be seen, and in most places inaccessible. The eastern side is of a far different character; the mountains slope more gradually towards the sea, the islands are intersected with fine capacious bays, thickly populated, and offering safe shelter to the navigator and the numerous fishing boats that visit it from all parts of the country. The shores around the bays and valleys are covered during the summer season with a luxuriant vegetation, which enables the inhabitants to keep considerable flocks of sheep.

In the west fiord the depth of water, about 14 miles off the islands, varies from 200 to 300 fathoms. Nearer the coast there is a fishing bank of irregular breadth; it does not deepen or slope gradually, but it consists of three terraces, or of several depths. Nearest the land, the bank has a depth of from 20 to 30 fathoms, extending itself for a certain distance at that level, when it suddenly drops to between 40 and 50 fathoms, which in a similar way extends some distance, when the third ledge or terrace appears, on which there is a depth of from 90 to 120 fathoms. South of this shoal there is no bottom with 300 fathoms. It is on these three ledges, or banks, that the great Loppoden fishery is carried on, affording, during that busy season, employment to upwards of 20,000 people.

ANTIQUITY OF MUSIC.

A LECTURE ON THE ANTIQUITY OF MUSIC; DELIVERED AT THE ROYAL ADELAIDE GALLERY.

By Mr. West, R.A. of Music; Professor and Vocal Director.

In referring to the various means noticed in the Bible as ministering to the comforts of mankind, music is the *only one*, the object of which was to animate the affections, and delight and refine the senses.

In the fourth chapter of Genesis, 20th and 21st verses, we read, "And Adah bare Jabal (B. C. 3875); he was the father of such as dwell in tents and of such as have cattle. And his brother's name was Jubal; he was the father of all such as handle the harp and organ."

The word "father" was given by the Hebrews to an inventor, or a most excellent master in any art; the very *art of music* is thus early ascribed to Jubal, so indulgent was the Creator to find means to divert melancholy, to animate the spirits, and to entertain and cheer mankind. From that time the inspired authors of holy writ, lawgivers, prophets, evangelists and apostles, the poets and philosophers of the ancient heathen world, and writers innumerable, both sacred and profane, of more modern times, have united in recommending the cultivation of music as a means of soothing the evil passions, softening the manners, improving the mind, and contributing to devotion. From the time of Moses (B. C. 1571) it was constantly employed in religious and civil festivals, in public and private rejoicings, and on occasions of grief and mourning. Females as well as males bore a part in such performances; legislators and prophets were their national bards, and judges and kings rejoiced to handle the harp and the lyre in the service of the God they adored.

In the 25th chapter of Chronicles we read, "All these were the sons of Heman the king's seer in the words of God, to lift up the horn; and God gave to Heman fourteen sons and three daughters. All these were under the hands of their father for song, in the house of the Lord, with cymbals, psalteries and harps, for the service of the house of God, according to the king's order to Asaph, Jeduthun and Heman." (B. C. 1015.)

The most sublime effect of music we have on record is given in Exodus; when at the glorious triumph of the Lord at the Red Sea, (B. C. 1491,) Miriam, the prophetess, took a timbrel in her hand and all the women went out after her, and the praises of the Deliverer of Israel were celebrated in the presence of the assembled camp.

> "Sound the loud timbrel o'er Egypt's dark sea,
> Jehovah hath triumph'd, His people are free!"

Musical exercises were made the business of the statesman, the warrior, and the bard, besides being applied by the heathen priests in the celebration of their religious rites.

The philosophers of every class considered it worthy of especial notice, and it was remarkable that Plato and Aristotle, who disagreed so widely in matters of philosophy and politics, were of one opinion with regard to music, as being the most efficacious instrument for humanizing the public character and providing for the virtuous education of the state.

When instrumental music was first invented, there is no reason to doubt but that vocal was cotemporary with it, and as Jubal (who was of the posterity of Cain) introduced the one, so it was the belief of the eastern nations that either the same person, or at least one of the same family, (who were all extinct at the Flood,) invented the other. Let us then suppose that music being thus introduced by Jubal, might in all probability before his death be known to Noah, and, as he instructed his family in other things, so also in this. When the world was repeopled after the flood, it is not improbable that Ham instituted the same in Babylon, (when the tower was erected,) where it was retained by the Chaldeans; and after that, when Ham and the offspring of Mizraim his son came into Egypt, music with other arts was transplanted there together with the inhabitants, and preserved not only until but long after the time of Moses; consequently the music of the Egyptians in those days (giving an allowance for some alterations according to the humour of different ages and countries, and also for their further improvements) did in a great measure resemble that which was first introduced by Jubal. If the temple service resembled the music of the Egyptians, and our cathedrals do in this imitate the temple, then it is evident that we have still among us a remnant of the greatest antiquity the world affords.

To render all this as probable as the nature of it will bear, it is requisite to consider that the land of Chaldea (of which Shinar or the plains of Babylon is a part) is a country most remarkable for its antiquity.

There was the garden of Paradise, where our first parents tilled the ground.

When the waters of the flood abated, the ark of Noah rested upon that part of the mountain of Ararat which was since called by the name of Caucasus, between the East Indies and Scythia.

An ancient author says, " and thereupon the sons of Noah, knowing the fruitfulness of the land of Shinar, made so much haste to come thither again, that they journeyed to the east for that purpose; and as both Ham and Japhet came thither in order to people the more western countries, so they brought with them the learning, and consequently the music, of the Old World, and the pillars and monuments of antiquity, which

might be found upon their coming to a land formerly inhabited, could not but be of great use to refresh their memories, and induce them to communicate their arts and sciences to posterity."

As the land of Chaldea was inhabited by Nimrod and his associates from the first building of the tower and the confusion of languages, and as the Chaldeans were originally famous for their learning, especially for astronomy, (having greater opportunities to make their observations of the stars, than if they had lived in an uneven or mountainous country,) so were they also skilled in music, and are mentioned in scripture as such who "used the flute, harp, sackbut, psaltery, dulcimer, and all kinds of song as well as instrument."

Kircher states, that after the flood the Egyptians were the first revivers of lost music, for they, having been taught by Ham, and Mizraim his son, had made so great an improvement in it, that the word "music" took its derivation from the Egyptian word "moys," which signifies water, because music was greatly improved near the standing pools or marshes of Nilus, and this improvement was occasioned by the reeds, which grew there in great abundance, and of which they made their trumpets.

Sir Walter Raleigh corroborates such statement. Speaking of their four kinds of learning, he says "That in the mathematical part, which was divided into geometry, astronomy, arithmetic, and music, the ancient Egyptians exceeded all others; but of music they desired no other account, nor further knowledge than seemed to them sufficient to magnify their gods, their kings, or good men."

That they were anciently acquainted with music is evident, as we are told by an historian who travelled in those parts, that the Egyptians sung a song like the Greeks, which they called "Linus," or in the Egyptian language "Maneros," which was composed to lament the death of the only son of their first king, who, as the same author tells us, was called "Menes," B. C. 2247.

Another historian informs us that Apiphanes was king of Egypt, and cotemporary with Serug, the grandson of Peleg, in whose days the earth was divided, and after him succeeded Pharaoh, the son of Sanes, from whom all the Egyptian kings were called "Pharaoh;" so that by comparing both authors together, it is probable that Apiphanes and Menes was the same person.

Nothing was more useful (says Plutarch) than music to stimulate mankind to virtuous actions, particularly in exciting that degree of courage which is necessary to brave the dangers of war; to this end some have used the lute and others the lyre.

The Lacedæmonians played upon the flute in approaching the enemy, the air that was composed to the song or hymn

addressed to Castor, and the Cretans played their military marches for many ages on the lyre.

The Thebans and Lacedæmonians had a flute upon their ensigns, and the Cretans a lyre; and many ancient nations and cities have impressed the lyre upon their coins as their particular symbol.

The city of Rhegium had a woman's head on one side, and on the reverse a lyre; the Thespians had one of the muses and a lyre; the Lapithæ a Diana, and on the reverse a lyre; the Isle of Chios, Homer on one side, and on the other a Sphynx with a lyre in its paw.

The Isle of Tenedos had on one side a head with two faces, and on the reverse an axe with a bunch of grapes, (the symbol of Bacchus,) and a lyre, (the symbol of Apollo.)

There was a provident community, of principles uncommonly severe, which fixed the subjects and movements of song and dance by law; this community was that of Sparta. The practice was not peculiar to this wise, though barbarous, commonwealth; it was borrowed from Crete, and came originally from Egypt. In that great fountain of ancient polity, not only the art of music in its enlarged sense, but even that of painting was fixed and made unalterable by law. Plato, who informs us of this, gives a particular detail of the musical establishment which sets the principle in a clear light, and corroborates what is now advanced. "All their songs and dances are consecrated to the gods, it is ordained what sacrifices shall be offered to each deity, and what songs and choirs shall be appointed to each sacrifice; but if any person makes use of any hymns or choirs in the worship of the gods other than what is appointed by law, the priest and magistrates expel him the community." This uncommon effort of Egyptian legislation, the Spartan lawgiver adopted from Crete, and by this severe establishment is said three times to have saved the state.

Innovations were attempted by three different musicians, Terpander, Timotheus, and Phrynnis; the sentence of the Spartan senate upon one of them is still preserved; it is this.

"Whereas Timotheus, the Milesian, coming into our city, and despising the ancient music; rejecting also that melody which arises from seven strings; and setting off his music by a multiplicity of strings, and a new species of melody, corrupts the ears of our youth; and instead of that which is legitimate and pure, corrupting the enharmonic by new, various, and chromatic sounds; and being called to the Eleusinian mysteries, did divulge the secrets of that institution. It seemed good to the senate and rhetors, that Timotheus should be called to account for these proceedings; that he be compelled to cut off the four superfluous strings from his lyre, leaving the seven ancient tones; and that he be banished to a distance from the city; that henceforward none may dare to introduce any new or dan-

gerous custom into Sparta, lest the honour of our musical contests should be defiled."[a]

It is supposed, from the account given by Eusebius of the consecration of churches in the time of the Emperor Constantine the Great, that it was not until the fourth century that music formed a regular part of the offices of the Christian church; afterwards, (for want of skill,) the laity became disqualified to bear their part in the service, and the Council of Laodicea, in the year 314, forbids all persons to sing in the church except the singing canons. Henceforward, musical science became confined, in a great measure, to the ecclesiastics, and was regarded as the peculiar business of monks and priests.

There is no doubt that music constituted a great portion of the religious ceremonies of the Romans and Greeks at all times, from the description of those ceremonies still to found in writers of antiquity.

Dionysius Halicarnassensis states, that Dardanus, upon consulting the oracle respecting his settlement, had this answer relative to the custody of the images of the gods. "Remember to establish in the city which you shall build, perpetual worship to the gods, and to honour them with safeguards, sacrifices, solemn dances, and songs."

There are no proofs remaining that any other language except poetry through the vehicle of music, had admisssion in the rituals of liturgies of the Pagans; all the praises and thanksgivings offered up to their several divinities, were songs and chorusses, accompanied by musical instruments, and generally by dancing, or at least by a solemn march and by gestures. Horace calls music "A friend to the Temple," and says, "The guardian gods of Numida are to be appeased by incense and music." Maximus Tyrius calls it "The companion of sacrifices;" and Proclus says, "The very avenues of the Temple were furnished with music."

Plato was such a friend to Temple music, as to wish that no other should be used either by gods or men; and it has been clearly proved, that in all nations, the first public use of music has been in the celebration of religious rites and ceremonies.

As Christianity was first established in the East, which was the residence of the first emperors who embraced the faith, and as the whole was regulated by the council and under the direction of Greek Fathers, it is natural to suppose that all the rites and ceremonies originated there, and were afterwards adopted by the Western Christians; and St. Ambrose is not only said (by St. Augustine) to have brought thence the manner of singing the hymns, but Eusebius observes that a regular choir and method of singing the service were first established, and hymns sung in the church at Antioch, the capital of Syria,

[a] Arati Phœnomena. Ed. Oxon.

during the time of Constantine, and that St. Ambrose, who had long resided there, had his melodies from that city.

But besides St. Ambrose, Augustin, and Gregory, who have all left clear testimonies of their approbation and even cultivation of music in the western church, the ecclesiastical historians are unanimous in recording the sanction that was given to it in the east by St. Basil, Chrysostom, and Jerom, and we find early mention, after the Christian religion was established by law, of chanters and canons being appointed to officiate daily in the church.

Socrates says, that Ignatius had conversed with the Apostles, and is generally supposed to have been the first who suggested to the primitive Christians in the east, the method of singing psalms and hymns alternately or in dialogue, dividing the singers into two bands or choirs, placed on different sides of the church, and this custom soon prevailed in every place where Christianity was established.

At the commencement of the 5th century, the Goths ravaged Italy; Rome was sacked and taken by Alaric; the Vandals, traversing Gaul, penetrated into Africa; the Huns into Italy; and the Franks, under Pharamond (in 493), made themselves masters of the northern part of Gaul, of which entire country his successors soon got possession.

In 476, Odoacre, King of the Herules, overturned the western empire; soon after this he was taken prisoner and killed in Ravenna, by order of Theodoric, who founded, in 493, the kingdom of the Goths, in Italy.

It may readily be imagined that in the midst of such revolutions, the arts were entirely neglected, amongst which music suffered greatly, so that at the commencement of the 6th century, when the whole western empire became barbarous, its music was entirely reduced to the chants of the church and the national songs of these barbarians; but the Goths who settled in Italy cultivated the arts, and soon begun to imitate the enlightened manners of the people whom they had subdued.

Ecclesiastical writers allow that it was Pope Gregory the Great (in 590) who collected the musical fragments of such ancient hymns and psalms as the first fathers of the Church had appointed and recommended to the primitive Christians, and that he selected and arranged them in the order which was long continued at Rome, and soon adopted by the chief part of the western church.

After this time, the Roman school of music shone with renewed lustre, and Clovis, King of France, requested Theodoric to send him a musician. Theodoric, wishing to please the king, sent him *a singer*, who had been selected as the best by the learned Boëthius, whom Theodoric afterwards caused to be beheaded.

"On the arrival of this musician," (says Wm. du Peyrat,)

"Clovis's priests and singers formed themselves after his style, and sung with greater gentleness and sweetness; having also learned to perform on various instruments, this monarch always used them after at divine service, which practice was continued under all his successors to the end of that generation." Thus it appears music was much in use at the courts of the first sovereigns.

When Charlemagne went to Rome, at the festival of Easter, in 787, a quarrel arose between the singers of France and Rome; the French affirming their singing to be superior to that of the Romans, and the Romans accused the French of having corrupted the Gregorian chant. The dispute was carried before the Emperor, who decided by asking the following question:—"Declare to us," said he to *his* singers, "which is most pure, water drawn from its source, or that which is taken from a distant stream?" "Water from the source," replied the singers. "Well, then," said he, "return to the original source of St. Gregory, of whom you have evidently corrupted the chant."

Kircher speaks of Guido using five lines and five spaces, but gives no authority, and he mentions many things from mere tradition which are anything but correct; but as he *gives* to Guido, so he also *takes away*, for he says that "points" were used long *before* the time of Guido, and instances an ancient MS. in the Monastery of Vallambrosa, where the melody to the famous hymn, "Salve Regina," is written in "points," on and between two lines only; it is not *certain* that Guido invented points, but it is generally allowed that this hymn was written by Hermannus Contractus, who died in 1054, that is, thirty years after the Micrologus of Guido was finished. He also asserts that Guido not only invented polyphonic music, or counterpoint, but the polyplectrum or spinet; for which there is not the least support to be found in the writings of Guido.

But many writers have fallen into worse errors than these, for instance:—D'Avella published a book at Rome in 1657, full of prejudices in favour of the rules, and many peculiar to the author: from his ignorance of history he advances innumerable absurdities, one of which is, that "St. Gregory ordered that no other gamut should be used in the church than that of Guido," when it is a well-known fact that Guido was not born nntil nearly five hundred years after the time of Gregory.

It is somewhat remarkable to find the love of excessive cruelty and the love of music in the same person; but we have a striking exemplification of this in the Emperor Nero; his cruelties are too well known to admit the necessity of a comment. In the year 60, he instituted exercises of music, poetry, and eloquence, to be performed at Rome every fifth year. In the year 63, he mounted the stage himself as a public singer; this was his first appearance as a strolling minstrel. His second

appearance was in Greece, in the year 66, where he pretended, in imitation of Flaminius, to restore to the Grecian states their ancient liberties. After entering the lists with the musicians at the Olympic games, and acquiring the prize by corrupting the judges or his competitors, he travelled through Greece, not prompted by the laudable curiosity of visiting the antiquities of that celebrated country, but by the low ambition of displaying his skill in singing and playing on the cithara. He everywhere challenged the best performers, and, as may be expected, was always declared victor. The solicitude with which he attended to his voice is curious, and will throw some light upon the practices of singers in ancient times. Suetonius tells us, that to preserve his voice, he used to lie upon his back, with a thin plate of lead on his stomach, took frequent emetics, abstained from all kinds of fruits, and such meat as was thought to be prejudicial to singers; and at length he ceased to harangue the soldiers or senate, but contented himself by issuing his orders in writing. After his return from Greece, he established about his person a *phonascus*, or officer to take care of his voice; he would never speak but in the presence of this vocal governor, who was first to admonish him when he spoke too loud, or strained his voice; and afterwards, if the Emperor, transported by some sudden emotion, did not listen to his remonstrances, he was to stop his mouth with a napkin. The most effectual means of acquiring his favour was to commend his voice, (which Suetonius says was thin and husky,) to pretend raptures while he sung, and to appear dejected and very importunate if, like many other singers, (through caprice,) he desisted from doing what he most ardently desired.

The father of Cleopatra, and the last of the Ptolemies, derived the name of Auletes or the flute-player, from his excessive attachment to that instrument. Strabo says of him, that, besides his debaucheries, he applied himself in a particular manner in playing on the flute. He had such an opinion of his own abilities, as to institute musical contests at his palaces, and had there the courage to dispute the prize publicly with the first musicians of his time.

Ricimer, king of the Vandals, having been defeated in a great battle by Belisarius, was compelled to fly to the mountains, and was there, with his army, invested by him: overwhelmed with grief, he made to the general this moving request:—"Send me a loaf of bread, lest I perish with hunger; a sponge to dry up my tears, and a musical instrument to console me under my afflictions."

Kircher has illustrated his account of the tarantula by histories of cases; and first, he speaks of a girl who, being bitten by one of these insects, could only be cured by the music of a drum. He then proceeds to relate that a certain Spaniard, trusting to the efficacy of music in the cure of the frenzy, occa-

sioned by the bite of the tarantula, submitted to be bitten on the hand by two of these creatures, of *different colours*, and possessed of *different qualities;* the venom was no sooner diffused through his body than the symptoms of the disorder began to appear; upon which, harpers, pipers, and other musicians were sent for, who by various kinds of music endeavoured to rouse him from that stupor into which he had fallen; but it was observed that the bites of the two insects had produced *different effects*, for by one he was incited to dance, and by the other he was restrained from it; and in this conflict of nature the patient expired.

Music is said by some of the fathers to have drawn the Gentiles frequently into the Church, through mere curiosity, who liked its ceremonies so well, that they were baptized before their departure: but in the present day, the generality of our Church music is such as would sooner drive Christians *out* of the Church, than draw pagans *into* it.

There is a very valuable musical manuscript in preservation which once belonged to Dr. Robert Fayrfax, an eminent English composer, during the reigns of Henry the 7th and Henry the 8th; it was afterwards in the possession of General Fayrfax, and upon his death formed a part of the Thoresby collection. It consists of a collection of the most ancient English songs, to which the music is preserved. The composers of these songs are William of Newark, Sheryngham, Edmund Turges, Tutor or Tudor, Gilbert Banester,—Browne, Richard Davy, William Cornishe, jun., Sir Thos. Phillips, and Robert Fayrfax.

Turges is a name well known among the musicians of Henry the VIth. Tudor was author of several compositions in the music book of Prince Henry, afterwards Henry the VIIIth. Cornyshe was of Henry the VIIth's Chapel; and Fayrfax was admitted a Doctor of Music, at Cambridge, in 1511.

With reference to Sir Thos. Phillyppes—*Sir* was a title formerly given to persons in orders, as well as to knights. Fuller, in his Church History, instances a great number of this class in St. Paul's Cathedral, in the time of Edward the VIth, and says, that such persons as have the addition of "Sir" before their christian names, were men not graduated in the university, being in *orders* but not in *degrees*.

This explains and gives considerable antiquity to a four part round, that was printed by John Playford, in "Catch that catch can," or a collection of catches, rounds, and canons, published by John Hilton, 1652.

"Now I'm married *Sir John* I'll not curse,
He joined us together for better, for worse;
But if I were single, I must tell you plain,
I would be advised ere I married again."

There is a curious copy of a commission granted by Queen Elizabeth, for the protection of the Welsh bards, which, after appointing twenty commissioners by name to carry her pleasure into effect, goes on to state,

"And therefore we require and command you by these presents, not only to cause open and public proclamation to be made in all fairs, market-towns, and other places of assembly, within our countris of Aglere, Carnarvon, Meryondd, Denbigh, and Flynt, that all and every person or persons that intend to maintain their living, by name or colour of minstrells, rhymers, or bards, within the talaith of Aberfraw, comprehending the said five shires, shall be and appear before you, the said day and place, to shew their learnings accordingly; but also that twenty, or not less than six, whereoff of you the said Sir Richard Bulkeley, Sir Rees Griffith, Ellis Price, and William Mostyn, Esqrs., or three or two of you to be of the number, to repair to the said place the days aforesaid, and calling to you such expert men in the said faculty of the Welsh music, as to you shall be thought convenient, to proceed to the execution of the premises, and to admit such and so many, as by your wisdoms and knowledges you shall find worthy, into and under the degrees heretofore in use, in semblable sort to use, exercise, and follow the sciences and faculties of their professions, in such decent order as shall appertain to each of their degrees; and as your wisdoms and discretions shall prescribe unto them; giving straight commandment in our name and on our behalf to the rest, not worthy, that they return to some honest labour and due exercise, such as they be most apt unto, for maintenance of their living, upon pain of being taken up as sturdy, rude, idle vagabonds, and to be used according to the laws and statutes provided."

There was a peculiar custom in Cheshire. During the sanguinary feuds on the Welsh borders which succeeded the conquest, and which continued more than two centuries, Randle Blundeville, the celebrated Earl Palatine of Chester, 1181, and founder of the then impregnable castle of Buston, was besieged in the castle of Rhuddlaw, by a numerous army of Cambro-Britons. He immediately dispatched a messenger to his constable, Roger Lacy, Baron of Halton, who, in the exigency of the moment, assembled at Chester, (it being the time of the fair,) a great body of idle and dissolute people, including all the fiddlers, minstrels, and players then present, besides a considerable number of women, and other dissolute people; with these he marched to the Earl's relief.

The appearance of this motley multitude operated so strongly on the fears of the Welsh, that they fled in all directions. As a reward for the signal services thus rendered, the Earl gave to "Roger Lacy" power over all the fiddlers and shoemakers in

Cheshire. The constable, however, presented his steward, Piers Dutton, with the authority over all the shoemakers, reserving to himself only the right over the fiddlers.

In the reign of Edward the IVth, music, after long living a vagrant life, and being passed from parish to parish, seems, by the favour of that monarch, to have acquired a settlement, for it appears by his letters patent, bearing date the 24th April, 1469, that this prince did, for himself and heirs, give and grant (unto Walter Haliday, marshal, John Cuff, Robert Marshall, and others, then minstrells of the said King) that "they by themselves should be in deed and name, one body and cominality, perpetual and capable in the law, and should have perpetual succession, and that they might at their pleasure name, chuse, and ordain, and successively constitute among themselves, one marshall, able and fit to remain in that office during his life, and also two wardens every year, to govern the said fraternity and guild."

CURIOUS MUSICAL ADVERTISEMENT.

Extracted from a collection of title pages, devices, and advertisements, in the British Museum. No. 5936.

"ADVERTISEMENT.

"To all lovers of the best sort of Music.

"Men say the times are strange—'tis true,
'Cause many strange things hap to be;
Let it not then seem strange to you,
That here one strange more you see.

"That is, in Devereux Court, next the Grecian Coffee House, at the Temple back gate, there is a deaf person teaching music to perfection, who by reason of his great age (77) is come to town with his whole stock of rich musical furniture, instruments, and books, to put off to whomsoever delights in such choice things; for he hath nothing light or vain, but all substantial and solid music. Some particulars do here follow.

"There is a late invented organ, which (for private use) excells all other fashioned organs whatever; and for which substantial *artificial* reasons will be given, (and for its beauty) it may become a nobleman's dining room.

"There belongs to it a pair of fair large sized concert-viols, chiefly suited for that or concert use, and 'tis great pity they should be parted."

He states, after speaking of other instruments he has for sale, "There is the publisher's own musical monument, some few copies thereof he has still by him to put off, it being a subscribed book, and not exposed to common sale; all these will be sold at very easy rates, for the reasons aforesaid, and because (indeed) he cannot stay longer in town than 4 months (exactly)."

Dr. Hodges' remarks are well worthy of general dissemination, he says:—

"In the consideration and discussion of the objects of study, we may include the design or intent with which the study itself is undertaken or pursued, the actuating motive or ultimate aim of the student in applying himself to the investigation of the particular art or science to which he may direct his attention, as well as the precise mode of best following up that study when entered upon.

This motive or actuating principle will perhaps in very few instances, be found to be very definitely ascertained, even by the student himself, unless the question shall have been previously put to him. It is the same with all the usual avocations of men. The caprice of the moment, the fortuitous circumstances of birth and education, the vacuity of idleness, the hope of some advantage, the influence of fashion, or it may be a sense of duty, with a variety of other, and possibly of very dissimilar causes, each in its turn, or altogether, may operate to determine an individual to the choice of this or that profession or calling.

As this happens with reference to the grand business of life, so also does it hold good with reference to our amusements and polite accomplishments, and in no case more than in that of the study of music.

It is necessary, therefore, to enquire of all new pupils or their friends, what definite object they have in view, in order thereafter to frame a plan whereby they may the more readily attain it.

The same enquiry may also be beneficially recommended to others, as well masters and governesses, as parents and pupils; and the determination of the question may possibly lead to a great economy of time, labour, and expense.

The object once defined, it will, of course, be the interest of the student to pursue it steadily, and if not irrational in its nature, he may be well assured, with almost a moral certainty of success.

I attach the condition of a possible absurdity in the object, because such a case is very conceivable; for instance, where a gentleman of some fifty or sixty years of age, shall betake himself, for the first time in his life, to the study or practice of some musical instrument, with the avowed purpose of rivalling thereon the most expert artists of the age—men, who have devoted all their days, and perhaps nearly all their nights too, to the attainment of the skill at which they have arrived;—forgetful of the fact, that although by the application of his mental powers, he may possibly outstrip them in scientific knowledge, yet, the very rigidity of his muscles must ever debar his attainment of any thing approaching to great manual dexterity.

There may be very many arguments advanced which may serve as an inducement to the study of music.

One takes up the subject from what we may call a 'com-

mercial,' or money-getting motive. It may be that his father was 'a professor,' and could find for his son no more advantageous or promising mode of life than that which he had followed himself. Such a motive is to be respected. The desire to gain an honest livelihood is not to be derided. But we may ask, how will this affect our art? Will not such a man, naturally, and almost necessarily, study rather what may be most profitable, than what shall best conduce to the propagation of correct taste and right feeling? Will he be likely to be over scrupulous about the moral effect of the exhibition of his talents and acquirements; or will he not be tempted to take them to that market, where (I will not say máy be most usefully employed) but where they will yield the best financial returns?

But another and a better motive, is that laudable inquisitiveness and desire for general knowledge, which leads a well-disposed mind to the investigation of this or any other subject.

That there is in the human race a natural aptitude for the enjoyment of sweet sounds, is an indisputable truth; and that it was the intention of our beneficent Creator that that natural propensity should be gratified by its appropriate pleasure, may be legitimately inferred.

We shall, therefore, find that the farther we dive into the mysteries of harmony and melody, the more clearly shall we be convinced that the Author of Nature is the Author of Music also, and that He doubtless intended it as 'one of the innocent delights of the sons of men.'

It was well said by a reviewer, that 'man was no more the inventor of the musical scale, than he was of the rainbow.' What pity it is then that it ever should be used for unholy purposes.

I do fearlessly avow the sentiment, that music, whether vocal or instrumental, is never so legitimately employed, and that its highest gratifications are never so exquisitely enjoyed, as when it is appropriately introduced into Divine worship.

I say 'appropriately,' because music may be introduced, which is not appropriate; or it may be most inopportunely employed.

The sentiment just avowed leads me to touch upon another motive, which I believe may actuate some few persons in their study of music, that is—a sense of religious duty. It has been emphatically urged by the Rev. W. H. Havergal, the duty of singing is as obligatory as that of praying, there being as much command for one, as there is for the other. Now, indubitably, if it be a duty to sing the praises of God, it will be equally a duty to cultivate the singing faculty, and to attain some knowledge of music. The Rev. Mr. Havergal closes his argument by saying, that the too frequent excuse is 'want of voice' —it is but another word for 'want of heart.'"

The following translation from the French will shew the great moral advantages derived from a cultivation of singing:—

"In the south-west of Switzerland, a musical revolution is rapidly taking effect. Its watchword is harmony: its object is to give a new direction to popular singing, and its means may be found wherever there are persons willing to take a little pains, and who can find a leader to give them a little instruction, and to guide their voices in singing the songs of their country and the praises of their God.

Long was it thought that French Switzerland could not march with the German cantons in vocal music. Long has the Lake of Geneva heard little along its shores but coarse, vulgar and obscene ballads. Lately the students of Geneva and Lausanne have laboured to counteract this evil, by composing patriotic songs, and endeavouring to give them popular circulation. The effect has been happily successful, but within a small circle. The religious awakening, which is making daily progress in Switzerland, has had great effect in improving the national singing. New methods have been adopted in many schools to train the children to the execution of hymns with a fine and simple harmony, and the effects have been so far pleasing—but something was wanted to reach the mass of the people, and that has been supplied.

A few years ago M. Kaupert, a Saxon gentleman, who has long resided at Morges, proposed to teach gratuitously the whole population of young and willing persons in any village or small town to sing together. The rumour attracted considerable attention, and drew forth a variety of opinions. But soon his promises were realized, and all scepticism was silenced. At Morges and in the neighbouring villages, concerts of the voice alone were heard, producing such a noble effect as no person in the whole country had before the least idea of. He was induced to extend his benevolent labours. He electrified as it were the whole side of the Lake of Geneva. Everywhere the magician of song was followed by crowds. The moral effect of this is beyond calculation already, the result excites astonishment.

M. Kaupert commonly began in schools and other large rooms; persons of all ages and of every rank in society flocked to these meetings. It was soon necessary to ask for the use of churches; and sometimes large assemblies have been held in the open air. In the former places hymns are sung,—and in the latter songs, patriotic and descriptive, but all free from any immoral taint.

These large assemblages followed his instruction and caught his method of execution with an enthusiasm perfectly astonishing. M. Kaupert's kind manner and untiring patience had a great share in producing the effects which so surprised them.

The city of Geneva invited the musical philanthropist to visit

and charm its population. Some of the higher classes became alarmed, but in the result, they too were willingly carried down the stream. Pastors, professors, magistrates, ladies of the first rank, persons the most distinguished for learning and science, were seen side by side with children and poor people, listening and learning. When the grand meeting took place, no church could receive the multitude, and they repaired to the Place du Palais, in number 4000 singers—the effect was sublime. M. Kaupert was loaded with expressions of admiration and thanks, and a medal was struck in honour of him, a mark of respect which in Switzerland is never conferred but upon those who possess the highest order of merit.

"At Lausanne his instructions were sought with universal avidity. Many who had been accustomed to spend their evenings in dissipation, began to employ them entirely in learning the new method. Children and their parents, all the schools, the professors and students of the college, servants and mistresses, workmen and masters, persons who had been the most opposed to each other in religion and politics,—the inhabitants of different villages distinguished by banners,—all were attracted, all seemed to be of one heart and soul. When the previous training was complete, a day was fixed for the grand concert. More than 2000 singers were arranged in the great church, the noblest Gothic building in Switzerland; the flags of villages and societies were tastefully disposed on an ivy-clad tower; the vast multitude who came to hear, were crowded within and without, and then was sung a hymn to an air of Luther's composing, simple, grave, noble, but, oh! the effect! no words can utter it; the impression will never be forgotten.—Other hymns were sung, and a most touching patriotic song, the words of which we owe to M. Oliver, named *La Patrie*, Our Country, Helvetia—Helvetia."

Bishop Horne says, "If we consult the pages of history we find that, among all nations where music has been at all understood and practised, it has always been applied in their religious festivals. Whatever was the object of adoration, in this manner was adoration paid; and as it is notorious that most of the rites to be found among idolaters were, originally, derived from the primeval church of God, and transferred to their false divinities, it is a fair supposition, that that which was practised by the one had been first practised by the other. Short as the account of things and persons is, in the Mosaic history, of an infant world, we read very early in Scripture of those 'who handled the harp and organ.'

It is impossible at this time to say, what specific instruments are denoted by the Hebrew words; that they denote musical instruments of some sort, there is no doubt.

No sooner was there a regular national church established in Israel, a people selected by the Almighty for that very purpose.

than we find music making a part of the ritual. 'The trumpet was blown in the new moon on the solemn feast day; such was the *statute* for Israel, the law of the God of Jacob.' The performers, vocal and instrumental, were ranged by the royal prophet, under divine direction, in their several classes, and appointed to wait in succession through the year.

At the dedication of the temple by King Solomon, they were all assembled and performed together, the whole nation joining in a grand chorus of praise and thanksgiving, while the glory of the Lord, a body of light above the brightness of the sun, descended from heaven, and filled the house of God."

I now conclude by stating that music, taken both in a religious and moral point of view, is of the utmost importance, and a powerful engine in the civilization of any country.

SYSTEM OF WOODEN RAILWAYS FOR IRELAND.

THE PROSSER PATENT.

By W. Bridges, Esq.

The truly admirable Report of the Irish Railway Commissioners of 1838, stated as their general conclusion, that parties might doubtless be found ready to undertake certain portions of the Irish lines which held out special prospects of advantage; such, for example, as the first twenty or thirty miles leading out of Dublin, over which all the traffic with other places, near as well as remote, must necessarily pass. But since, according to their calculations, the return of profit on the whole system could not be expected, for some time, to exceed 3½ or 4 per cent., it was manifest that if the best and most productive portions were taken possession of unconditionally, there could be no reasonable hope that the remainder would ever be carried into effect. This would so completely frustrate the most important of the objects contemplated in issuing the commission, by opposing a bar to the future improvement of the country, that the Commissioners urgently recommended that such a system, or rather departure from system, should not be permitted. It is, indeed, a conclusion which every one will form for himself on perusing the Report referred to, and the Appendices containing the surveys and estimates of Mr. Vignolles and Sir John Macneill, that the Government would act wisely in arranging that the railways of Ireland, *if constructed on the existing principles*, should form one grand system; that every effort ought to be made, in accordance with the recommendation of the Report, "to combine into one interest, and under one management and control,

the whole of the southern system of intercommunication between Dublin and Cork, Limerick, Waterford, and Kilkenny; and that the northern line, by Navan, be treated according to the same principle, and considered as one concern."

But while it is apparent that, even as a system, a congeries of iron railways in Ireland, the average expense of which was by the Commissioners, and is now, estimated at £11,000 or £12,000 per mile, will not be immediately or speedily remunerative, it is yet most desirable that, whether undertaken by a Government or by private enterprise, every public work of this character should be self-supporting. That railways create traffic, by creating the facilities for traffic, is demonstrated by the experience of England; but it cannot be concealed that Ireland, steeped in poverty to the very lips, cannot be expected at once to manifest that full degree of energy and commercial enterprise, the assurance of which could alone justify such expensive undertakings.

That Ireland, however, has made such progress within this century as might well excuse the expectation of its supporting an *economical* system of intercommunication, is yet abundantly obvious: and it may be safely assumed, that if the great ports and interior towns could be connected together by a system of roadway equally durable, safe, and expeditious as that of the iron railway, at a fraction of the expense, not only would a greater boon be conferred upon Ireland than any which Government could bestow, but an immediate revenue of large amount would accrue on the investment. It is now capable of demonstration, that a system of wooden tramways, equally expeditious, and more safe, more durable, and infinitely more economical than the iron railway, might at once be introduced into Ireland, to the mutual benefit of the English, Scotch, and Irish capitalist, merchant, and labourer.

The system referred to is that about to be practically exhibited on several projected lines: from Guildford to Woking, from Hyde Park Corner to Richmond and Staines, from Gloucester to Fishguard, from Waterford to Kilkenny, and others; the average total cost of which will not exceed £5000 per mile.

The new mode may be thus described. The rails, or rather trams, of seven to eight inches scantling, are indurated and protected against the ordinary destructive agencies of fire, rot, and insects, by a very philosophical process, to wit, the injection, by successive exhaustion and pressure, of two solutions, mineral and alkaline, which by decomposition transmute the timber into a new and incorruptible substance. These trams are laid down on the principle of the "double way" of the ancient tramroads, which is also the modern principle of the Great Western Railway; that is to say, they are let into wooden transverse sleepers, and secured thereon by wedges, forming one great frame of longitudinal and cross sleepers, on

the levelled surface of the ground. The tires of the wheels are perfectly flat, and before and behind each carriage two guide-wheels are fixed, at an angle of forty-five degrees; a deep groove in their circumference embraces the upper and inner edge of the trams, and the friction being thus thrown upon the axle, the carriages are guided with perfect safety, and without any perceptible abrasion of the rails. Upon a level, experiment has proved that less power is required to move an equal weight upon a railway of this construction than upon the flanged wheel carriage of an iron rail; at the same time, the bite of the wood affords a greater power of ascending gradients, and the bevel wheels give the facility of traversing the sharpest curves. A machine of seven tons can thus mount and descend gradients of less than one in twenty, and traverse curves of 500 feet radius at the rate of twenty-five miles an hour. On the one hand, the durability is attested by the fact that wood properly prepared has recovered the deflexion occasioned by the pressure of 140 tons upon a segment of an iron wheel three inches in the tire, and that an experimental traffic equivalent to seven years of an ordinary line did not obliterate the saw-marks upon the wooden trams, which, on the contrary, actually polished the bevelled surface of the guide wheels.

The superiority of longitudinal sleepers over stone blocks and chairs, is demonstrated by the successful experiment of the Great Western Railway; and the rationale of such a mode, and its peculiar adaptation to the circumstances of Ireland, in spite of the abundant stone of that country, are well exhibited by Mr. Vignolles in the Appendix to the Irish Railway Report, (Appendix A. No. 1.) The rigidity and the vis inertiæ of stone supports, indeed, may be held to be one among the many causes in operation which induce such a fearfully rapid wear and tear upon some of the existing railways. Another advantage of the prepared longitudinal beams is to be found in the action of the deliquescent salts which enter into their preservative composition, and which effectually prevent slipperiness from frost, and from the opposite extreme of intense summer heat.

The comparative saving in the mere superstructure of wooden and iron railways, may be thus tabularly exhibited:—

WOODEN RAIL.

	£	*s.*	*d.*
5280 cubic ft., 2*s.* per ft.	528	0	0
Paynizing	62	8	0
Wedges, labour and carriage	300	0	0
Contingencies . . .	240	0	0
3520 sleepers, at 3*s.* 6*d.*	616	0	0
	1746	8	0
Balance in favour of wood in *superstructure alone*	1809	12	0
	3556	0	0

IRON RAIL.

	£	*s.*	*d.*
With rails 60 lbs. to the yard, it will cost for rails, chairs, bolts, &c.	2400	0	0
Labour and carriage .	300	0	0
Contingencies . . .	240	0	0
3520 sleepers, at 3*s.* 6*d.*	616	0	0
	3556	0	0

Besides this, there will be at least one-fourth less cutting, and a continuous saving in wear and tear of machinery, carriages, &c., which may be two-thirds less in weight with equal tractive power. But the immense saving in construction, in superstructure, earthworks, embankments, masonry, and purchase of land, is even of less importance than the immense moral and social advantage which the system involves, of connecting towns and villages in all directions, which the present mode altogether excludes from the benefits of more rapid intercommunication. On the present system, a saving in the expense of embankments, necessarily involves an additional cost of working. A better illustration of this cannot be found than in a comparison of the two surveys of Sir John Macneill, in his valuable Report on the North Irish line, (Report, Appendix, No. 4.) There are scarcely any gradients or curves in the Irish Railway Report which need be avoided by the guide-wheel system of wooden railways. By such a system, a line from Shrewsbury through Wales, to Port Dynllaen, even more direct than that suggested by the Commissioners, might in the first place be thus constructed for less than one million sterling, bringing Dublin within twelve hours of London; and thereafter the Irish metropolis might be brought into rapid communication with every town in Ireland at an average cost of 4,000*l.* per mile.

To sum up the benefits to be anticipated from the adoption of the new system.

First, as regards the details of expenditure:—

Tunnels, deep cuttings, embankments, and bridges will, in most cases, be entirely obviated, seeing that gradients of 1 in 20, and curves of 500 feet radius may be readily surmounted at a speed of 25 or 30 miles per hour: the purchase of land is reduced in amount; the material is greatly cheaper than iron; engines and carriages may be reduced to one third of the usual weight, with greater tractive power; the annual wear and tear is also reduced, and as the rails are laid down on the existing face of the country, no disfigurement of the ground is necessary upon private estates, which are ordinarily deteriorated to an extent for which no amount of compensation can be an adequate equivalent; and at the same time as a necessary consequence, the crossings from one part of an estate to another, may be maintained in every direction.

Second, as regards the public interest:—

Safety is insured by the use of the guide wheels, which, being adapted to the upper and inner edge of the rail, and attached at an angle of 45°, preclude the possibility of an overturn, while by their peculiar construction, scarcely coming into play except when a great centrifugal influence arises, there is no calculable amount of abrasive action on the tram.

Cheapness of transit to all classes is of course induced by the

reduction of primary expenditure; and ease and comfort are in an eminent degree secured by the avoidance of those causes of oscillation which are involved in the use of the conical tire on the iron system.

CAPT. WARNER'S EXPERIMENT AT BRIGHTON.

ON CAPTAIN WARNER'S EXPERIMENT AT BRIGHTON, AND ON EXPLOSIVE COMPOUNDS AS APPLICABLE TO WARFARE.

THE experiment performed by Captain Warner, off Brighton, has called great attention to explosive compounds; immediately after the experiment, we are informed, no less than sixty applications were made to the different Boards, by individuals professing to be in possession of some equally destructive engine. Not one of these gentlemen, probably, was in the slightest degree acquainted with that branch of chemical decomposition, on which the power of the invention must depend; and from the speech of Sir Robert Peel, it is very clear, that Capt. Warner is not himself very much advanced. Of the power of projecting to such an enormous distance as Capt. Warner speaks, we look upon it as a physical impossibility. As to explosive compounds, we do not think he has shewn that he knows more than what others do, and he has as yet done nothing which has not before been effected by others.

The proportions of nitre, charcoal, and sulphur in gunpowder may have been altered, but still the ingredients are the same; the powder used at the battle of Cressy, in all probability, was but a rough specimen of the last shots fired at Tangiers. If a powder were invented sixty times the strength of gunpowder as now manufactured, its introduction, save as a matter of economy, would be doubtful. Ten pounds of gunpowder will throw a ball three miles; six thousand tons would not throw it one yard further, nor would the most dangerous chemical compounds project it one half so far, however unlimited the quantity used might be.

At an enormous expense, the French government constructed an immense bomb, which at the siege of Antwerp threw a shell weighing 1600 cwts., holding 1 cwt. of gunpowder, but the opinions of the first chemists were against its utility. It was urged before its manufacture, that no weight of metal could stand the strain of the powder required to project so immense a weight, and the result proved the correctness of these views: at the eighth shot it cracked. Last year, some experiments were made at Deal, on large guns; several burst, and, notwithstanding every precaution, three artillerymen were killed. Still later, an immense gun was manufactured in the United States: the first shot went well; at the second, though the

gun had just come from the proof, it burst, the fragments killing several members of the congress near it; and the opinion of chemists is now nearly adopted by the authorities, that beyond 68 lbs. any ball is dangerous. With the detonating compounds, which the inventors bring forward, power would be even lost: their explosion is instantaneous, and their effect is seen more upon the gun than on the missile. By the substitution of chlorate of potash for nitre, a terrific compound is formed; every soul perished at the first manufactory it was attempted in; sufficient, however, was afterwards made for trial, 8 lbs. were fired in a gun, the ball was projected 600 yards, (with gunpowder it would have gone 1200,) and the gun was rent to pieces. It was suggested that shells might be advantageously charged with it, the power being very greatly increased, but when the proposer, an eminent chemist, after proving experimentally the increased destructive effect, pointed out the spontaneous ignition, and the dangers of the manufacture, the officers, to whom it was referred, expressed their surprise that any thing so clearly impracticable should have been presented by a chemist.

There is another explosive compound, the chloride of nitrogen, made by inverting a jar of chlorine gas into a strong solution of muriate of ammonia, at 100° Fahrenheit; the chlorine is absorbed, and an oily liquid collects at the bottom; this from experiments would appear to be 400 times the strength of gunpowder; but even if that extreme facility of decomposition, which nearly deprived its discoverer, Sir H. Davy, of his eye, and which the recent accident to Professor Ryan proves we have as yet no means of guarding against,—if even that could be overcome, the ball would not be projected one yard further. If additional power could do it, we have an unlimited supply in gunpowder. The fulminates are clearly useless; their explosive action, like that of the chlorate gunpowder, would tend but to shatter the gun; and as Capt. Warner's experiments are so expensive, it is probably on one of them he has been engaged.

Had Capt. Warner been acquainted with these facts, he would not probably have continued to assert that he had discovered any such powerful engine of destruction. The philanthropist might shudder at the idea that, armed with such means, a man could at the dead of night destroy a city, with its thousands or millions of unsuspecting inhabitants; but chemistry knows no such power, nor have the researches of our professors at all pointed out, that such could exist? Lord Ingestrie, who brought forward Capt. Warner's invention, and in distinct terms pledged himself to its value, was on a former occasion sufficiently inconsiderate to give a certificate to John St. John Long, that he had seen him extract pure mercury from the living, but probably brainless, scull of one of his patients; and our readers may remember an inventor calling himself the Duke of Normandy, who claimed the possession of

a power which annihilated all space. By some chance, his experiments were tried at Woolwich, and not one succeeded; his income was limited, but still, though ruin stared him in the face, this inventor went on in his wild search for this power. Mr. Fulton, during the time of Pitt, devised a plan to destroy vessels at sea, and so plausible appeared his invention, that government at a great expense tried it. He succeeded when experimentalizing before the officers of his own nation, but though the idea of a submarine boat, and the exploding case of gunpowder to fire by watchwork, would appear practicable, in every instance before the enemy he failed; the great difficulty being to get unperceived to the vessel, as the sailors would of course be obliged to come occasionally to the surface to see if they were on the right track.

The debate in the House of Commons divested the experiment at Brighton of the slightest interest: the vessel was dragged on to the shell as it floated down the tow lines; and it would have been equally as easy, and quite as satisfactory, had he blown her up with a fusee attached to a barrel of powder. But on one point we must congratulate Capt. Warner: his powerful interest has thrust him upon the government, which is generally extremely summary in rejecting adventurers;—he is forced upon them. Out of 100 things which are monthly suggested, 90 are clearly impracticable, and of the other 10, eight have been probably before tried and failed; and how can the remaining two be expected to receive a fair consideration? It is found that, in criminal cases, three or four successive verdicts of guilty render the next prisoner's chance of escape but small, and 98 inventors being humbugs, the other two are too often classed with them. We remember a case where an invention of great importance was submitted to the Admiralty. After an inspection of the drawings, the inventor retired to an adjoining room, and must, we believe, plead guilty to the overhearing of the private conversation between one of their lordships and his secretary. "This" said the zealous servant of the public, "is likely to be a troublesome fellow; you must get rid of him quietly, or he will bother us dreadfully." The secretary appeared before the expectant, full of assurances of the consideration his invention should receive, complimenting him upon his ingenuity, and gracefully bowing him to the door, with a promise that he should soon hear from him; the inventor did in this case hear, but it was five years after, and his invention had in the mean time been adopted in the merchant vessels. The fear of being anticipated preventing the speculator from consultation with those, who could have instructed him upon the probable absurdity of the plan he proposes, he submits his drawings; as a matter of course they are civilly declined; and he indignantly publishes his neglect. Other inventors sympathize with him, and the scientific man, who is really

wronged, shrinks back in silence, almost fearing lest, surrounded and mixed up with these unthinking fools, he may have even imbibed their wild ideas; hence improvements emanate but from officers.

The records of the Select Committee are full of inventions, scarcely one of which required even a trial to prove its inapplicability. We remember one submitted by an extremely clever gun-maker; it was a musket, in which the fire communicated to several cartridges; a soldier could thus with once pulling the trigger, fire seven times without reloading or even removing the gun from his aim; a hundred soldiers could thus deal destruction upon an advancing column. The theory appears good, but apply even for a moment the chances of actual warfare: by case or cannister-shot, twenty of these, after the first shot, fall dead or wounded; their guns fall from their hands, discharging their contents amidst their own ranks, each man as he falls adding to the confusion. "You must," said the good-natured inventor, "issue a standing order that each soldier, when dying, should stick his musket into the ground." A hundred more such instances could be adduced.

The working of the present system is to confine all improvements to officers, for they have alone the opportunity of trying them. In the percussion shells, a missile to which the authorities directed considerable attention, this was particularly marked. Lord Vivian requested every scientific person whom he met, to invent a shell which should explode on striking, requiring for this purpose no fuse, a constant source of annoyance and failure, and offering every facility for trial the Board of Ordnance could give. A host of adventurers came forward, the wildest theories were tried. The soi-disant Duke of Normandy stood conspicuous; with a box, about four feet square, he offered to blow down a mound, 1,300 feet long and 200 broad, into which a cannon-ball could not enter three feet. He could explode the box at a given moment; the time passed; the soldiers fired it with a fusee, and instead of displacing the mound, the earth around was barely displaced. He had invented a musket-ball which set fire on striking, and he came provided with a figure filled with combustibles; shot after shot was fired into it, but with no effect. The duke advanced with a cigar, but the figure appeared incombustible; by means, however, of some straw, it was at last fired, and a discharge of squibs and two small rockets followed. But, as if to crown his misfortunes, he had invented a percussion shell; it exploded at the mouth of the gun. It was evident during the loading that it could by no possibility succeed.

Sir George Murray came into office, and the facilities for trials were at once closed. Finding themselves classed with ignorant adventurers, most of the scientific persons had before withdrawn. Should it for a moment be now urged, that some latitude should be allowed for the trial of experiments, which, requiring guns

and trained men, could be tried by government at an expense so trifling as to be undeserving of notice, but by an individual who would require to purchase all that government have, at one of a ruinous nature, this result is appealed to. We did, says Sir George Murray, and see how it acted; failure succeeded failure; every fool seized this opportunity of obtaining notoriety, and of course all failed; and if any of those who at the solicitation of Lord Vivian had engaged in these dangerous experiments, and whose shells having in some instances succeeded, had showed, that by perseverance, without which, success, save by accident, is never obtained, they could probably have succeeded; they are classed with these adventurers, their applications are refused, complain for a moment of the injustice, urge the absence of a trial, adduce the authority of chemists, that the failure after success would not involve the principle, which before being given up would require several more trials, for which the men, gun and grounds, if not ammunition, might be at least spared. "Give but this trial," and immediately a host of Normandys spring up yelling, "we also have not had a trial," and amidst their yells the voice of truth is stifled. It is an evil against which we have no cure.

A letter was lately published in the Times by some one, offering to destroy a barge for 110*l.*, to which he required a tow-line to be attached; conversation with a sensible person would have shown him that he could no more expect an enemy to allow him to attach a line than to introduce a fusee in their powder magazine, and if with a chemist, his means of destroying the vessel would have probably equally proved inapplicable. The chloride of nitrogen is the compound which the friends of these adventurers point out as likely to have been by them rendered manageable. On the grounds that "Fools rush in where angels fear to tread," we really believe that this compound is by some really considered applicable; to them this extract from the letter of Sir H. Davy, its discoverer, while engaged in experiments, most carefully conducted, may prove a warning. If in the hands of this great chemist it was unmanageable, if more lately another chemist had his arm fractured, what fate could one unskilled in manipulation expect? "I attempted," says Sir H. Davy, "to collect the products of the explosion of the new substance by applying the heat of a spirit lamp to a globule of it confined in a curved glass tube over water: a little gas was at first extricated, but long before the water had attained the temperature of ebullition, a violent flash of light was perceived, with a sharp report. The tube and glass were broken into small fragments, and I received a severe wound in the transparent cornea of the eye, which has produced a considerable inflammation of the eye, and obliges me to make this communication by an amanuensis. This experiment proves what extreme caution is necessary in operating on this

substance, for the quantity I used was scarcely as large as a grain of mustard seed." But, as we have before explained, for any purpose of projecting these compounds are useless; they would in every case destroy the gun, besides throwing the ball but a short distance.

When Captain Warner speaks of his six-mile range, for which he required but a two-pounder, he states a physical impossibility in the present state of chemical science; and Captain Warner is certainly not one in whom any reasonable hope could be indulged, that by his knowledge any advance will be made. By the use of the fulminates, nothing would be gained, for with compounds so loosely held together, there appears no certainty; they are all liable to spontaneous decomposition. The fulminate of mercury was considered safe while mixed with spirit of wine, yet while in this state it exploded, and Mr. Hennell, of the Apothecaries' Hall, was destroyed by it. Mr. Eley, the inventor of the wire cartridges, who had repeatedly mixed his fulminate of mercury, perished from the explosion of a pound of this highly dangerous composition. A French vessel, fitted, during the French war, with some new detonating compounds, was never heard of after it sailed from Toulon. The large gun made for Mehemet Ali, requiring a charge of 40 lbs., and throwing a ball of 480 lbs., is considered too dangerous to use. Rockets of 100 lbs. are not found to move one yard. There appears to be a limit to destructive powers, and we have reason to thank Heaven it is so. The service may be improved, rockets may eventually be made to go straight, shells may be made percussioned, and a greater precision given to cannon firing. It is possible, by the introduction of the patent principle of Mr. Harding's new gun, which has given so great an increase to the power of sporting guns, we may improve that of the cannon; but these, if effected, would be but a slight step to realizing the theories of Warner or of Normandy. The evil they cause, and that is a serious though unavoidable one, is that scientific characters are debarred from the ground these enthusiasts claim as their own. Every application for experiment is now refused at Woolwich, because ninety-eight out of a hundred applicants prove to be ignorant adventurers.

Since writing the above, Captain Warner has addressed a letter offering to destroy a vessel at five miles, if guaranteed 300,000*l.* by the government. We think the offer might be safely accepted. We firmly believe it to be beyond the range of possibility. The gentleman who amused us last year with a promise of navigating the air, was quite as loud and quite as bold in his assertions as is Capt. Warner.

REVIEWS.

The Alpaca; its Naturalization in the British Isles considered as a National Benefit, and as an Object of immediate Utility to the Farmer and Manufacturer. By WILLIAM WALTON. Blackwoods.

AT a moment when the philanthropist, alarmed by the results of the last census, and shuddering at the consequences of that distress which continues to prevail in the manufacturing districts, complains of our over-population, and recommends emigration as a remedy, this neat little volume, with two classical illustrations, will be deemed a seasonable acquisition by the public. The author, who has evidently devoted much time and labour to his subject, and, besides, must have had facilities in his researches which no other individual could have enjoyed, gives his readers to understand that, instead of being dismayed at the productive powers of our women, and instead of sending forth what is called our "surplus population" into distant climes, there to contend with difficulties and endure the horrors of solitude, we ought to look around us and see whether our waste lands are properly turned to account, and whether we cannot devise some means of employing our spinners and weavers thrown out of work, and at the same time try if we cannot increase our stock of butcher's meat. Mr. Walton does not merely propound the question; but in a clear and powerful manner shews how the three desiderata above enumerated, to a certain extent at least, may be attained by the naturalization of a new species of sheep, the fleece of which, resembling silk, yields seventeen pounds of wool, worth from two to three shillings per pound, while the flesh holds a middle rank between mutton and venison.

Our limits would not allow us to dwell at any length on the utility of this really farmer's manual, or to point out the masterly manner in which the author has performed his task; but we think it our duty to convey some idea of the nature of the work, which will be best done by glancing at its contents. These briefly stand thus: history and properties of the alpaca —its wool and meat—its applicability to our soil and circumstances—benefits which would accrue to the farmer and manufacturer from its naturalization—results of the experiments already made—errors committed by our breeders—diseases and treatment—safe and economical mode of procuring stock—national advantages, &c.

From this little sketch, a tolerably correct notion may be formed of the scope afforded to the author; and in unfolding his subject we may safely say, that he has been ably and patriotically supported by some of the principal breeders in Ireland and Scotland, as well as in England, the results of

whose experiments are given in their own words. Among the English amateurs may now be ranked Prince Albert, who, for the last year, has had a pair of alpacas at Windsor, one of which, from over-kindness, there is reason to apprehend, died about six weeks ago; and its fleece, weighing sixteen pounds, we are given to understand, is about to be manufactured, at Bradford, into dresses for the special wearing of her Majesty. Among the English breeders is the Earl of Derby, who is believed to be the largest proprietor of Andes sheep in the kingdom, but who has fallen into the great error of crossing the alpaca with the llama, and besides, keeps these Alpine animals in close parks and menageries, instead of allowing them a mountain range, and stationing them in a congenial clime. Mr. Walton hits his lordship rather hard, and we think deservedly too; for no man has had so fair an opportunity of conferring a great and permanent boon upon his country as the Earl of Derby, one of the earliest possessors of alpacas at a cheap rate, if he had only treated that interesting animal as farming stock, and not as a mere object of natural history.

We could not render that justice to this important subject which our inclinations prompt us to do, by entering into de tails, but there is one part of it, viz., the applicability of the alpaca to our soil and circumstances, upon which it is but fair that the author should speak for himself.

"From the experiments already made, not only in the British isles, but also in several parts of Europe, we are now sufficiently well acquainted with the properties of the tame species of Andes sheep, to feel assured that they are hardy animals, and easily fed. From unquestionable authority, we also know that they were found in the highest degree useful by a race of secluded mountaineers, engaged in the peaceful occupations of pastoral and agricultural life, and who without them scarcely could have existed. Of the two kinds, the alpaca, as before stated, is evidently the most valuable; as, besides furnishing a wholesome and nutritious food, it yields a fine and glossy wool, which might easily be made the staple commodity of a new manufacture, and by thus opening another source of trade, help to remove that pressure which bears so heavily upon various classes in the community.

"By trials commenced more than twenty-five years ago, it is equally placed beyond doubt that this animal may, without any great difficulty, be naturalized among us, and made to propagate; and every day the facilities and the efficacy of the scheme to adopt it, become more apparent. The hardy nature and contented disposition of the alpaca, cause it to adapt itself to almost any soil or situation, provided the heat is not oppressive, and the air pure. The best proof of its hardiness is its power to endure cold, damp, hunger, and thirst, vicissitudes to which it is constantly exposed on its native mountains; while

its gentle and docile qualities are evinced in its general habits of affection towards its keeper.

"No animal in the creation is less affected by the changes of climate and food, nor is there any one to be found more easily domiciliated than this. It fares well while feeding below the snowy mantle which envelopes the summits, and for several months in the year clothes the sides of the Andes. As before shown, it ascends the rugged and rarely trodden mountain path with perfect safety, sometimes climbing the slippery crag in search of food, and at others instinctively seeking it on the heath, or in rocky dells shattered by the wintry storm; at the same time that, when descending, it habituates itself to the wet and dreary ranges on the lowlands, so long as it is not exposed to the intense rays of the sun."

"Many of our northern hills would try the constitution of any sheep, and yet there the weather is never so inclement or so variable as on the Cordilleras of Peru. With so many advantages, why then shall not the alpaca have an opportunity of competing with the black-faced sheep, the only breed that can exist in those wild and inhospitable lands? Of the two, the stranger would fare best on scanty and scattered food, at the same time affording to the owner a far better remuneration. When ordinary sheep are removed from a cold to a warm climate, the wool becomes thin and coarse, until at length it degenerates into hair. This is the case with those taken from England to the West India Islands; whereas the merinos conveyed from Spain to Peru, and bred upon the Andes slopes, yield a fleece which, when well dressed, is preferred by the manufacturer to that of the parent stock.

"As regards the alpaca, we bring a lanigerous animal from a dreary and barren situation to one equally well suited to its habits, and at the same time infinitely healthier and better adapted for feeding. The result, therefore, could not fail to be favourable. The atmospheric changes in our climate can have little or no influence on an animal constitutionally hardy and so well coated; and by the adoption of this stock we not only secure to ourselves a new raw material for our manufactures, but also an additional provision of butcher's meat.

"If the animals take to the soil, and this, as before observed, they have done even in situations by no means well chosen, an increased weight of both fleece and carcass must follow. An improvement in the quality of the wool may be equally looked for; it being abundantly proved that pasture has a greater influence on its fineness than climate. The staple, also, cannot fail to grow longer, if the animal has a regular supply of suitable food; and, for reasons already explained, this is more readily met with on our mountains than on those of Peru, where the flocks are exposed to great privations.

"In other respects, the alpaca would prove an economical

stock. It is freer from constitutional diseases than ordinary sheep, and less subject to those arising from repletion and exposure to rain; neither are its young liable to those accidents which befall the lamb. The mothers are provident and careful nurses; nor do the young ones require any aid to enable them to suck. Except at the rutting season, these animals stand in need of no extra attention; neither are they predisposed to take cold. In this respect, the alpaca is pre-eminently favoured by nature. Its skin is thick and hard, and, being covered with an impervious coat, it is not injured by moisture. Snows and storms never affect these animals. Unhurt they pass through the utmost rigour of the elements, and hence the precautions adopted by our shepherds on some bleak localities, with them would be superfluous.

"Another remarkable feature in the alpaca is, that it does not often transpire; for which reason, and its peculiarly cleanly habits, the fleece does not require washing before it is taken from the back. Although often confined to regions, where

'Snow, piled on snow, each mass appears
The gather'd winter of a thousand years,'

the alpaca is not subject to catarrhs, or to those disorders which disable the limbs. The chest being guarded by a callosity, or cushion, which comes in contact with the ground while the animal reposes, the vital parts are not injured should the flock be obliged to pass the night in a damp or unsheltered situation. Besides being free from the diseases incidental to common sheep, the alpaca is less exposed to what are called 'outward accidents.' The facility with which this animal escapes from the fatal consequences of a snow-storm, is a valuable property. One shudders at reading the graphic description, given by the Ettrick Shepherd, of those sudden and awful calamities which have so often overtaken the farmer in the Scotch Highlands, when

'The feathery clouds, condensed and furl'd
In columns swept the quaking glen;
Destruction down the vale was hurl'd
O'er bleating flocks and wondering men.'

"I know not whether, in our hemisphere, the winters have become more severe than in ancient times; but since the well-known 'Thirteen Days' Drift,' supposed to have taken place in the year 1660, at which period so large a portion of the Scotch flocks was destroyed, and so many persons perished, it is a fact that we have had no less than thirty-six inclement seasons, during which the losses among sheep were incalculable. Nor have these misfortunes been confined to Scotland. The fall of snow, which occurred towards the close of February 1807, was so heavy in England, that in exposed situations the herds and flocks extensively suffered. Of the large number of sheep, on that occasion, overwhelmed in the Borough Fen,

near Stamford, only 600 could be dug out alive, the rest being completely buried in the snow. Upwards of 2000 perished on Romney Marsh, and the desolation equally spread to other places.

"In our islands, sheep are sometimes smothered by the snow falling down upon them from the hills, or perish in an accumulation of drift. Frequently they have not the courage, or the strength, to extricate themselves; but from his greater size, boldness, and activity, the alpaca is better able to contend with the storm. In their own country, these animals have an unerring foresight of approaching danger, and, collecting their young around them, seek the best shelter which the locality affords. After a tempest seldom is one missing, although they are, as it were, left to themselves, and the country bare of trees. Nothing can be more interesting than to see a flock of Andes sheep overtaken by a storm, and crossing a valley, with the drift reaching to their very backs. Raising their heads in a bold and majestic manner, the old males take the first line, and by pushing through the barrier, or jumping upon it when resistance is too great, succeed in opening or beating down the snow, so as to form a path for the weaker ones to follow." pp. 48—50; 55—61.

We are sorry that we have no room for further extracts; but, before closing this notice, we deem it our duty to state that, sensible of the importance of introducing the alpaca into Scotland, in 1841 the Highland and Agricultural Society offered their gold medal for the best treatise written on the subject, which was awarded to Mr. Walton; and this year, at the Glasgow cattle-show, which took place in the early part of last month, they announced premiums for the best pair born in the country, and the two best imported. The successful candidate was Mr. G. Stirling, of Craigbarnet Place, Lennoxtown, an extract from whose letter in reference to his little pet, two months old, and born on his own estate, we have it in our power to subjoin.

"*August* 12.—My chief reason for delaying to answer your letter was my wish to see what would take place at our Highland agricultural show, which took place at Glasgow. The great day of the exhibition was upon Thursday, the 8th instant, and certainly it was one of the most splendid shows of *first-rate* stock, I believe, ever seen in Scotland; but I need not dilate upon it, as you will see it fully reported in the newspapers. My alpacas, with the youngster, were the only ones exhibited. They were much admired; and indeed, latterly, they became the attraction of the immense multitude congregated together in the show-ground. The young one was particularly admired, and it was the wish of the Committee that its likeness should be taken, but the day was unfortunately wet and cold, and it being so young, I was afraid to allow it to remain, and

sent it home. However, it is quite well and was nothing the worse for its journey to Glasgow, and its long confinement in the show-yard. Notwithstanding the bad day, the number of spectators was immense; and, so far as I heard, no accident happened."

A Lecture on the late Improvements in Steam Navigation. By JOHN O. SARGENT. New York, Wiley and Putnam.

THIS pamphlet appears at a striking moment before the public, for it gives us some idea of the treatment which distinguished mechanics receive at the hands of the heads of our different departments. Ericsson, a Swede, who had acquired in his own country and in England considerable reputation for mechanical contrivances, and whose name, connected with that of Braithwaite, had been favourably known, was the person who invented the propeller to supply the place of the paddle-wheel in steam-boats. It was composed of a series of spiral plates attached to the outside circumference of a short cylinder, which is supported by two or more winding or twisted spokes, differing from the Archimedean screw, which is a thread or spiral blade coiled round an axis.

The propeller is placed at the stern of the vessel, and instead of revolving in a plane parallel to the keel, like the ordinary paddle-wheel, it moves in a plane at right angles on a shaft or axis parallel to the keel. The principle was suggested from Ericsson's observation, that all propulsion in nature is produced by oblique action; it is thus that birds, insects, and fishes move through their respective elements. In all vessels, having a large draft of water, the propeller acts entirely below the surface, and in vessels of a light draft it is only partially immersed. In war, a vessel thus prepared gives no warning to an enemy of her approach, for she is noiseless. She is protected in her motion from the missiles of the enemy, for her acting power is below the water; in ordinary navigation, she can avail herself of her sails, a co-operation of which the paddle-wheel does not allow the ordinary steam-ship to avail itself. Ericsson, after various experiments, made a boat which excited no small interest on the Thames: he invited the Board of Admiralty to take an excursion in tow of this boat.

"Accordingly, the gorgeous and gilt Admiralty barge was ordered up to the Somerset House, and the little steamer was lashed alongside. The barge contained Sir Charles Adam, senior lord of the Admiralty; Sir William Symonds, chief constructor of the British Navy; Sir Edward Parry, the celebrated commander of the second North Pole Expedition; Captain Beaufort, the chief of the Topographical Department of the

British Admiralty, and others of scientific and naval distinction. In the anticipation of a severe scrutiny from so distinguished a personage as the chief constructor of the British navy, the inventor had carefully prepared plans of his new mode of propulsion, which were spread on the damask cloth of the magnificent barge. To his utter astonishment, as we may well imagine, this scientific gentleman did not appear to take the slightest interest in his explanations. On the contrary, with those expressive shrugs of the shoulder, and shakes of the head, which convey so much to the bystander without absolutely committing the actor,—with an occasional sly, mysterious, undertone remark to his colleagues,—he indicated very plainly that though his humanity would not permit him to give a worthy man cause for so much unhappiness, yet that 'he could an if he would' demonstrate by a single word the utter futility of the whole invention.

"Meanwhile, the little steamer with her precious charge, proceeded at a steady progress of ten miles an hour, through the arches of the lofty Southwark and London bridges, towards Limehouse, and the steam-engine manufactory of the Messrs. Seaward. Their lordships having landed and inspected the huge piles of ill-shaped cast iron, mis-denominated marine engines, intended for some of his Majesty's steamers; with a look at their favourite propelling apparatus, the Morgan paddle-wheel, they re-embarked and were safely returned to the Somerset House, by the disregarded, noiseless and unseen propeller of the new steamer.

"On parting, Sir Charles Adam, with a sympathizing air, shook the inventor cordially by the hand, and thanked him for the trouble he had been at in showing him and his friends this *interesting* experiment; adding, that he feared he had put himself to too great an expense and trouble on the occasion. Notwithstanding this somewhat ominous finale of the day's excursion, Ericsson felt confident that their lordships could not fail to perceive the great importance of the invention. To his surprise, however, a few days afterwards, a friend put into his hands a letter written by Captain Beaufort, at the suggestion, probably, of the Lords of the Admiralty; in which that gentleman, who had himself witnessed the experiment, expressed regret to state that their lordships had certainly been very much disappointed at its result. The reason for the disappointment was altogether inexplicable to the inventor: for the speed attained at this trial far exceeded any thing that had ever been accomplished by any paddle-wheel steamer on so small a scale.

"An accident soon relieved his astonishment, and explained the mysterious givings-out of Sir William Symonds, alluded to in our notice of the excursion. The subject having been started at a dinner table when a friend of Ericsson was present, Sir William ingeniously and ingenuously remarked, that 'even

if the propeller had the power of propelling a vessel, it would be found altogether useless in practice, *because* the power being applied in the *stern* it would be *absolutely impossible* to make the vessel steer.' It may not be obvious to every one how our naval philosopher derived his conclusion from his premises; but his hearers doubtless readily acquiesced in the oracular proposition, and were much amused at the idea of undertaking to steer a vessel when the power was applied in her stern.

"But we may well excuse the lords of the British Admiralty for exhibiting no interest in the invention, when we reflect that the engineering corps of the empire were arrayed in opposition to it; alleging that it was constructed upon erroneous principles, and full of practical defects, and regarding its failure as too certain to authorize any speculations even of its success. The plan was specially submitted to many distinguished engineers, and was publicly discussed in the scientific journals; and there was no one but the inventor who refused to acquiesce in the truth of the numerous demonstrations, proving the vast loss of mechanical power which must attend this proposed substitute for the old-fashioned paddle-wheel." pp. 13—17.

Accordingly the invention was neglected in England; it was taken up in America, the war steamer Princeton, of the United States, was launched on the Delaware upon this principle, of which the following particulars are well worthy consideration:—

"In the Princeton, the cylinder of the propeller is eight feet in diameter, and twenty-six inches long; and the extreme diameter described by the outer edges of the spiral plates is fourteen feet. It is manufactured wholly of composition metal, the copper of the vessel, in connexion with the sea water, exciting a galvanic action which corrodes iron and renders it inapplicable for this purpose.

"The steam machinery of the Princeton is quite as worthy of observation as her propeller. It is evidently not enough, in a ship of war, that the propeller alone should be placed below the water line; it is indispensable that the whole machinery should be placed out of the reach of shot. The ordinary steam engine is too bulky to admit of this location, and Captain Ericsson has invented and constructed an engine upon a novel principle, by which he has been able to effect this most desirable object. Any one, of skill or knowledge in mechanics, will be instantly struck by this beautiful engine as the most remarkable feature in the ship; in view of the vast power that it embodies in so small a compass, and the perfect symmetry and exquisite proportions of all its working parts. It has been patented in England, and in this country, by Captain Ericsson, under the name of the semi-cylindrical steam-engine. It differs from other engines in the construction and operation of

its working cylinders. In the place of complete cylinders, semi-cylinders are employed; the pistons of which, instead of being circular, and traversing from end to end of the cylinder, consist of parallelograms, having a radial or vibrating movement, similar to that of a pendulum, the centre of motion being the centre of these semi-cylinders. The semi-cylinders are placed longitudinally in the very bottom of the vessel, and parallel to the line of keel. Motion is given to the propeller-shaft by means of short connecting rods, attached to vibrating crank levers on the axes of the vibrating pistons; and the latter are made to reciprocate by the admission of steam, alternately, on opposite sides, as in ordinary engines.

"This semi-cylindrical engine of Ericsson marks an epoch in the history of steam-engines. It is so compact that it occupies only one-eighth of the bulk of the British marine engine of corresponding power, and is less than one-half the weight. By a peculiar construction, the moving parts have been rendered so extremely light, that the quantity of matter to be kept in motion is hardly one-sixth that of the engine to which I have alluded. This lightness and simplicity of arrangement enable Ericsson to give a direct movement to the propeller-shaft, without the intervention of cog-wheels and other gear for multiplying the speed, resorted to in the Great Britain steam-ship, and indispensable in all steamers propelled by the Archimedean screw. The engines of the Great Britain, owing to their cumbrous nature, must be worked at a speed only one-fourth that of the screw—that is, the screw will perform four revolutions to one of the engine.

"The next peculiarity to be noticed in the Princeton is the absence of the ordinary tall smoke pipe, employed to produce the draft for keeping up combustion in the furnaces of the boilers. The smoke-pipe has hitherto formed an insuperable objection to a steamer as a ship of war; for the moment that it is carried away, the efficiency of the engines ceases from want of steam. The draft in the boilers of the Princeton is promoted by means of blowers placed in the bottom of the vessel, and is quite independent of the height of the smoke-pipe, which is only carried about five feet above the deck of the ship. If this inconsiderable projection should become partially deranged by a shot, the draft kept up by the blowers will continue as efficient as before.

"It is not out of place here to observe, that Ericsson was the first to apply to marine engines centrifugal blowers, now so common in this country in all boilers using anthracite coal. In the year 1831 he applied such a blower, worked by a separate small steam-engine, to the steam-packet Corsair, of one hundred and twenty horse power, plying between Liverpool and Belfast." pp. 38—41.

A very ingenious account is then given of Ericsson's caloric

engine, founded upon the theory that heat as an agent exerts mechanical force, but undergoes no change. This has led him to the construction of an engine worked by atmospheric air, which returns the heat at each stroke of the piston, and uses it over and over again. To this subject we may again have an opportunity of reverting.

PATENTS.

No. II.

PAPERS ON THE PATENT LAWS AND INVENTIONS OF GREAT BRITAIN, AND ALL FOREIGN COUNTRIES, GRANTING THE PRIVILEGES OF A BREVET.

COMMUNICATED BY MR. ALEXANDER PRINCE.

OFFICE FOR PATENTS, 14, LINCOLN'S INN FIELDS.

THE especial conditions under which inventors receive the privileges of a brevet in France, and other foreign states, differ greatly from those which govern the patent grants of our own country, and the points of difference between them are seriously important to the interests and the security of inventors, of whatever country, who seek to establish their discoveries under the protection of a privilege in any state foreign to their own. These differences taken generally, are strikingly remarkable;—they are at variance as well in the spirit of their intention, their bearing and application to the subject, their practical working, and their results; and it may be fairly said, that in a very considerable degree they influentially direct and govern the progress of invention itself.

It is in this feeling, and with this view of the subject, that we shall here direct the attention of inventors of all countries to the Patent Laws, their workings, and their progress in each; and as the most recent legislative measure on the matter, and that which certainly presents, on the whole, the most perfect and wholesome code of regulations, we shall commence our series with the new law of France on the subject of patents of inventions, which, after a long and protracted discussion in the French Chambers, received the final sanction of the legislature by passing the Chamber of Peers in June of the present year, and was promulgated or published on the 8th July. Its operation commences at the expiration of three months from that date.

A rapid analysis or digest of this new law, will probably be satisfactory to inventors and practical men connected with scientific invention. We shall therefore give this in the first instance, and in our succeeding paper give a close translation of

the official publication at full length, afterwards entering upon the necessary disquisition thereon.

The leading and most important features of the new law are as follows:—A brevet is now to be obtained for five years, at a cost of 500 francs; for ten years, for 1,000 francs; for fifteen years, for 1,500 francs. Such fees are paid by annuities or yearly instalments of 100 francs for each year of the duration of the brevet; the non-payment of any one of such instalments involving the positive forfeiture of the right. The mode of application for the brevet is described, and a statement of the documents required of the inventor to support his application. Instructions are given regarding the precise nature and description of such documents, the mode of drawing them up, and the necessary observances to be made in their preparation. The first instalment of 100 francs of the fee is paid on the application. The brevet takes its date from the day on which the documents are deposited. On the enrolment of the application, the documents are forwarded under the seal of the inventor to the minister, who opens and enrols the same in his department, in the order of date in which they are presented. At the expiration of each three months, a list of all brevets granted during that period is published by official authority. The natural duration of a grant cannot be extended, but by a special law passed for that particular case. At any time during the term of a patent, the inventor may make additions or improvements on his invention, at a cost of 20 francs.

If the holders of a brevet, or any person holding a license under them, take a brevet of improvement on the original invention, all licences have the benefit of the brevet of improvement. An inventor having an improvement or addition to his original brevet, may obtain an original brevet for such improvement for five, ten, or fifteen years, paying the full fees. None except the holder of a brevet, can obtain a new brevet for an improvement on the original within twelve months. Any other person may apply for a brevet of improvement, by depositing a description thereof, under seal, with the minister. At the expiration of twelve months, the description is opened, and the brevet delivered, unless the original inventor has, during the same period, made a similar application, in which case he is entitled to the preference, and receives the new brevet. If a brevet is found to interfere with an invention already existing, such new brevet cannot be used without the consent of the original inventor. The original inventor cannot, on his part, use the subject matter of the new brevet. All transfer of rights under a brevet must be made by a notarial act, and that after full payment of the fees. Persons holding licence under a brevet participate fully in the benefits of all brevets of improvements on the original; and, reciprocally, brevets of improvement obtained by those who hold licences are for the joint benefit of

the original and the licensee. Persons interested in any brevet of improvement may obtain a copy of it at a cost of twenty francs. The specifications and drawings of all brevets are in the custody of the minister until the expiration of the term for which they are granted, after which they are open to the public, without fees, and copies may be obtained at their own cost. No discovery or invention shall be deemed new, of which, before the date of the application for a brevet in France, sufficient publication has been made to enable others to put it into execution. A brevet is forfeited if its annual payments are not made *before* the commencement of each year of its term; if the invention be not put in operation in France within two years from the date of the brevet; or if its operation shall cease during two consecutive years, unless sufficient justification be given for such inaction and delay. Proceedings for the repeal or forfeiture of a brevet may be sustained by any person having an interest in such proceeding, and all such proceedings to be brought before the civil tribunals. If the subject of the brevet be either not new, or be not of practical character, the minister can take the necessary proceedings to procure its annulment or forfeiture. Infringement on the rights of a brevet incurs a forfeiture of from 100 to 2000 francs. Repetition of the offence of infringement subjects the party to the punishment of imprisonment, in addition to the fine. Workmen infringing, or confidential servants of the inventor's establishment aiding them in the offence, are also punishable by imprisonment. Or if the party infringing is aided in the offence by such workman or confidential servant, the owners of a brevet may obtain an order from the president of the tribunal for the co-operation of the officers of the court in designating the offence, and proving the infringement. After the payment of the second instalment, the descriptions and drawings are published; and at the commencement of each year, a list of brevets granted during the current period. These descriptions and drawings are collected and deposited at the secretary's office of the prefecture of police in each department of France, and open to inspection.

The rights of foreigners, established by the new law, are important:—1. Foreigners may obtain brevets of inventions in France, under the forms and conditions defined by the new law. 2. The author of an invention or discovery already patented in a foreign country may obtain a brevet in France, the term of such brevet being limited to that of the foreign patent on which it is founded. Brevets are forfeited, 1. If the invention be not new, or be any pharmaceutical composition, or secret remedy whatever, or contain any plan or scheme of finance. 2. If the invention consists only of methods or discoveries of theoretical matters, of which the practical application is not carried out and described. 3. If the title under which the brevet is

obtained fraudulently set forth any object other than that which is truly the object of the invention. 4. If the description given by the inventor be insufficient to explain the practical modes of putting his invention into operation, or does not set forth the inventor's mode of doing this, completely and in good faith. 5. If the brevet has been obtained for improvements not having distinct relationship with the original brevet.

The new law comes into operation in three months after its promulgation or publication; this being dated the 5th July last, fixes the commencement of its operation the 5th October of the present year. From that date, all previous laws on the subject of inventions and discoveries are repealed; but all brevets in present operation retain their rights during the term for which they are granted. All legal proceedings already commenced before the 5th of July must be continued as under the old law; but all such proceedings taken subsequently, shall proceed by the regulations of the new law, although the subject matter of such proceedings shall relate to brevets of anterior date.

Specification of the Patent granted to SAMUEL DOBREE, *of Putney, in the county of Surrey, Gent., for "certain Improvements in the manufacture of Fuel."* Sealed February 17, 1844.

To all to whom these presents shall come, &c., &c.—I declare the said invention to consist in a new and peculiar mode of heating a mixture of coal-dust, breeze, cinders, or other matter of similar nature, with pitch or other bituminous substance; such heating being performed by means of the following apparatus. I provide a vessel of iron or other metal, such vessel being in its conformation and mode of construction capable of containing steam of high pressure. This vessel is surrounded by an outer vessel forming what is generally called a steam jacket, and this also must be capable of bearing high pressure steam, and both the inner and outer vessels must be provided with safety valves, and be formed with a man-hole at the top, and also another man-hole at the bottom; and such man-holes must have close covers. I provide a steam cock to the outer vessel or steam jacket, by which high pressure steam may be admitted from a suitable boiler, and I form a communication between the outer vessel or steam jacket and the inner vessel, by means of a cock opening into the latter from the former, which may be opened at pleasure. The outer vessel is provided with a discharge cock at its lower end or side for the purpose of taking off the condensed water of the steam.

The operation of the invention I describe in manner follow-

ing: that is to say, I take the dust of coal of any description, or breeze, or cinders, or other matter of similar nature, and I mix such dust or matter with pitch, or other bituminous substance, in the following proportions, or in such proportions as the combustible character of the dust of coal, breeze, or cinders, and of the pitch or bituminous substance may be found to render necessary to form a compound possessing the best combustible qualities. In general, I find the following proportions of such ingredients to be fitting for the purpose, and useful in practice. I take for steam fuel, from seven eighth parts to eleven twelfth parts of coal in dust, and this I mix intimately with pitch powdered finely, or other bituminous matter, in the proportion of from one eighth part to one twelfth part, and I make as perfect a mechanical mixture of these materials as possible.

I generate high-pressure steam of a pressure equal to about sixty pounds on the square inch, in the boiler connected with the apparatus, and opening the cock of communication between such boiler and the outer vessel or steam jacket, I admit such steam of high pressure thereto. The outer vessel or steam jacket being thus supplied with high-pressure steam, the inner vessel being closed, becomes thereby heated. The mixture of ingredients above described is then thrown into the inner vessel, and the man-hole closed down. Slightly damping the mixture will facilitate the heating. I then open the cock of communication between the inner and outer vessels, and so admit high-pressure steam to pass from the outer into the inner vessel, and I allow such steam to pass until a pressure of about six pounds to the square inch is obtained in the inner vessel. The cock of communication between the inner and the outer vessel is then shut off, and the steam contained in the inner vessel is allowed to escape freely. The substances composing the mixture will then be found to be heated, the pitch or bituminous matter melted or softened, and the entire mass of the ingredients so amalgamated with each other that the compound can be formed into small blocks, or portions, by pressure in moulds of such figure as it may be found expedient to give to such blocks or portions, in order to fit them for convenient application to the purposes of fuel. The said blocks or forms so produced as above described, must then be placed in a hot closet until the moisture they may still retain shall be evaporated and dried off, when it is fit for use.

I declare that I claim, as the said invention, the process of heating mixtures of combustible matters and substances, in the proportions herein above stated, or in any other suitable proportions, by high-pressure steam generally, but more particularly in a double vessel of such general form and construction, and of such subordinate arrangements, as herein above described, and the conducting and aiding such process by the

application to it of high-pressure steam; the particular geometrical form or figure of such vessels being such as shall be found suitable to the due performance of the said process, and convenient of construction in practice.

In witness whereof, &c.

Enrolled Aug. 17th, 1844. SAMUEL DOBREE.

Specification drawn by Mr. Alexander Prince, 14, Lincoln's Inn Fields.

REGISTRATION OF DESIGNS FOR ARTICLES OF UTILITY.

Under the Act 6 & 7 Vict. cap. 5.

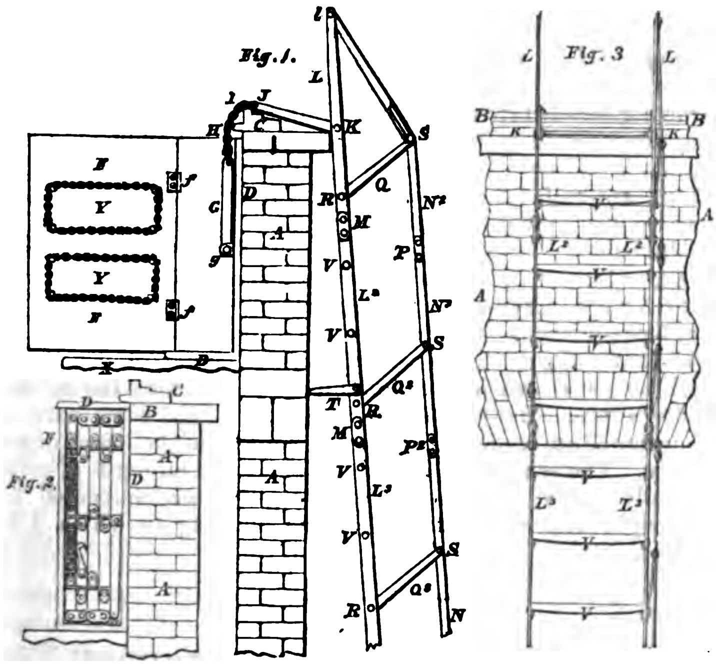
A new Fire-escape. By JOHN LEACH, Millwright, of Sheerness, Kent.

THIS extremely beautiful invention is a fire-escape, or fire-ladder, bearing the invaluable character of a *self-acting* machine, which insures to the inmates of a dwelling-house on fire ample means of escape in cases where external communication is cut off or impeded, and thus, by its self-action, places them in complete independence of casual assistance from without. The most remarkable features of the contrivance are its rapid facility of application, and its almost instantaneous automatic or self-arrangement of parts. These points, considered together, go far to remove the indistinct dread we have of being unprepared with the means of escape at the moment of need; it certainly affords a confident feeling of security, inasmuch as we may retire to rest with the assurance that a powerful apparatus of safety is always at hand, and under our own positive control.

Description of the Engraving.

The figure 1, represents the machine in profile, or side elevation, with a portion of the front wall and window of the dwelling-house to which its application is made. A A A shews the front wall; B, the coping of its parapet; C, the sill and lower portion of one of the upper windows, to which the machine is fixed. D D D are the sides of a small closet or box, E, constructed either of wood or metal, in which the machine is at all times placed and kept ready for use. F is its lid or door; G is an iron bar, hung by its lower extremity on a joint-pin, G, and at its upper extremity carrying an attached chain, H I; to the end I of the chain is hung the bar J, and at K this is attached to the bar L, by a joint-pin. At M, two check plates form a

joint on which is hung a bar, L², similar to the bar L. At M², which is the extremity of the bar L², another joint-piece carries the bar L³, similar to L² and L; and a series of such bars thus



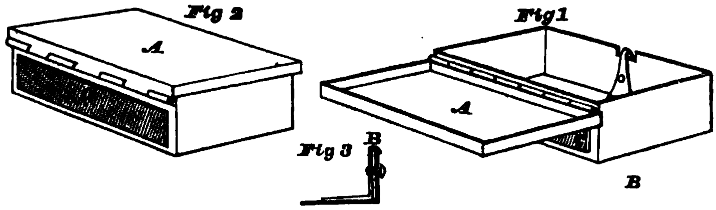
jointed is continued to any length that the height of the dwelling-house or building may require. At *l*, the upper extremity of the upper bar L, there is jointed a bar N; at its other extremity, S is a jointed piece which connects it with a second bar, N². At P, the bar N² is attached, by a joint similar to that at M, to a third bar, N³. At P², a similar joint connects the bar N³ with the bar N⁴; and this series of bars, thus jointed, is continued to the same extent of the first series of bars L, L², L³, &c. Q, Q², Q³ are short bars attached to both the above-mentioned series of bars, L, L², L³, and N, N², N³, by one extremity, by a joint-pin at R; by the other extremity, by a joint-pin at S. T is a shorter bar, hanging freely on a joint-pin to the bar L³, its purpose being to act as a prop to hold the series of bars L, L², L³, clear of the wall A A; and at convenient intervals in the length of this series of bars, there is placed a prop similar to T, each succeeding prop being longer than its preceding one in the series, in order that the lower portions of the machine may slope gradually from the front of the wall. A second set of the first of these series of bars is made, and iron plates are fixed transversely and between the two series, as the rounds or steps of a ladder, and thus forming the fire-

escape, or a ladder of safe descent; the second or smaller series of bars, N, N^2, N^3, N^4, forming its side-rails. The ladder thus composed, and attached by its upper extremity to the closet E at G, as described, is simply thrown forward over the sill of the window, and its lower end falls to the ground, unfolding itself as it descends by the weight of the parts and the action of their joints; and also by a simultaneous action throwing forward its side or hand rail, and propping itself at a suitable distance from the wall or front of the building. F F is the door of the closet above described, hinged to it at *ff*. At Y Y are coils of rope or chains, by which to sling and to lower down articles of value, or to assist persons descending by the ladder. X in figure 1, shews the floor of the apartment to the window of which the fire-escape is fixed, and kept ready for use. Figure 2, is a separate view of the machine as it appears when it is folded up and placed in the closet E, as described. Figure 3, is a front view of the portions of the machine as shewn in the figure 2; both sides of the safety-ladder appear. In the figures 1, 2, and 3, the same parts of the machine are respectively marked with the same letters of reference. The scale of general dimensions and strength of parts naturally varies, both being, of necessity, accommodated to the height and circumstances of the building to which it is applied.

A Metallic Safety Lucifer Match Box.—By WILLIAM WRIGHT, of Great Queen Street, Lincoln's Inn Fields.

This design, although one of minor character as regards its mechanical features, yet possesses considerable merit on the score of its presenting one of those numberless useful products of ingenuity, which, however unpretending in themselves individually, do yet, in the aggregate, minister so powerfully to our comforts, as really to become individually indispensable to us. If we regard the instantaneous light-box of our day, with reference to the rude process by which alone we obtained light, even so lately as thirty years ago, a little philosophical consideration will allow the humble match-box its claim to a place in the ranks of scientific inventions. The object of this inventor has been to make a lucifer match-box, of perfect security as against the not unfrequent accidental ignition of its entire contents, a circumstance involving considerable danger; and rendering it more unerring and effective in its simple operation. The first point is obtained by constructing the box itself altogether of metal; and the second, by providing a plane of rough metal, of proper construction, on which to ignite the match, instead of the slight and imperfect sanded paper of common use.

The engraving represents perspective views of the apparatus, drawn to a scale of about one-third of the full size adopted in practical use. The figure 1, represents the box opened, show-



ing its interior. The figure 2, represents the box when closed, showing its exterior appearance. The box is made of wrought iron; it has its lid A hinged on one of its longer sides, and closes by a snap spring B, on the opposite side. The lucifer matches are deposited in the interior of the box, and on the back of the body, at C, a small float file is fixed, upon which, in use, the match is ignited by friction in the usual manner. The figure 3, represents a sectional view of a portion of the front side of the box, showing the spring fastening B.

A new Chimney Cowl, by ROBERT STEDALL, *of Greenwich, Kent.*

The peculiarity of the arrangement of parts, and the construction of this Chimney Cowl, is important; it consists firstly, in that it presents no obstruction to the passage and action of the sweeping brush used to cleanse the chimney, and so obviates the necessity there exists with other cowls for a separate sweeping brush of peculiar form for their cleansing, and involving a distinct operation, which is frequently of very difficult character. Secondly, in that its construction gives it an internal passage, presenting no projecting parts, on which any such deposit of soot can take place, as may obstruct or lessen the free draught of the chimney.

In the engraving, the figure 1 is a perspective view of the cowl, and figure 2, a view in plan, having the top or upper plate removed. A is a pipe or conduit of metal, the lower end of which has a flanch, B, by which the cowl is connected with, or fixed upon the top of the chimney shaft. To the upper extremity of the pipe A, a horizontal plate, C C, is fixed; and from the sides of this there proceed four vertical plates, D, E, F, G; these are so disposed as to leave the vertical openings or passages H, I, K, L for the admission of the wind to the cowl, and its egress with the smoke rising into the cowl from the chimney shaft, through the corresponding and opposite vertical openings. To the upper extremities of the vertical plates D, E, F, G, there is fixed the horizontal plate or wind-guard M, closing the hori-

zontal opening formed by the vertical plates; and, at equal intervals or distances from each other, on the outer side only, of the vertical plates, are fixed narrow horizontal ledges or plates,

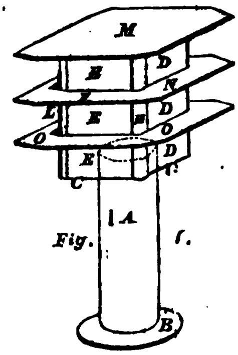


Fig. 1.

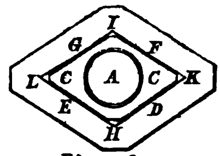


Fig. 2.

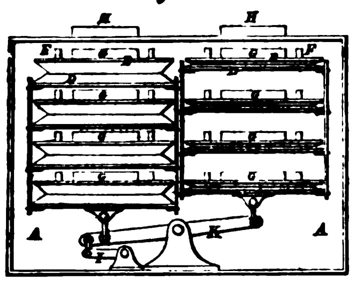
N, O, the outer edges of which have the same projection as the outer edges of the upper plate M; the vertical plates D, E, F, G are placed in the rhomboidal figure indicated by the figure 2, and the upper plate M, with the narrow outer horizontal plates N, O, take the same arrangement and disposition. The force and rapid action of this cowl is produced by the obliquity of the vertical plates, and the directing influence of the horizontal plates N. O.

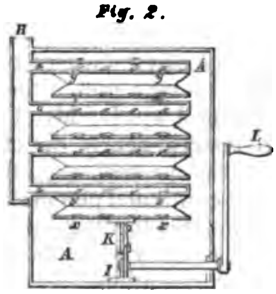
A Ventilator for Public Buildings and Private Dwellings, by WILLIAM HILL, *Organ Builder, of Tottenham Court Road, London.*

This invention consists in a very ingenious and comparatively inexpensive arrangement for the purposes of ventilation, and is composed of two sets of compound bellows, which are made to act alternately by the agency of a simple winch, to be worked by one man. The machine is placed in any convenient or suitable part of the building to be ventilated; or, being easily portable, is removed from one place to another as the occasion for its operation may require. Its action is, as it were, to seize and drive off a vitiated atmosphere, while a supply of pure air is allowed to enter, from the best sources of supply the locality and

general circumstances of the building to be ventilated may afford.

Fig. 1. Fig. 2.





In the drawing, figure 1 represents a longitudinal and vertical section of the case or vessel containing the machinery. Figure 2 represents a vertical and transverse section of the same.

The cavity or inclosure of this case is marked A A A in both the figures. A double arrangement of bellows is constructed on the general and well-known principle of the blowing apparatus of organs and similar machines. B represents one of the arrangements, and C the other; each consists of a bellows of a single action or chamber, that is to say, of two flaps, respectively marked D and E; D being the moveable face of the chamber, and E its fixed face. F F F are stops, which hold the fixed face E. The same letters of reference being placed respectively on the same parts, the action of the machine will be understood by reference to the transverse section at figure 2, together with the figure 1.

In the figure 2, the under face of each bellows has apertures for the inspiration of air, *x x*, &c., and the upper face of each has corresponding apertures for its exit; each aperture having a flat valve, Z, opening upwards. The air is drawn through the under face by the apertures *x x*, and is driven out by the apertures, Y Y, &c. Air passages or conduits marked G, carry the air so discharged, and deliver it to a main air trunk or chimney, H. The two sets of bellows are actuated alternately by the system of levers shewn in figures 1 and 2 at I and K, and working by the winch at L.

Registration drawn by Mr. Alexander Prince,
14, Lincoln's Inn Fields.

Harding's New Patent Gun.

Mr. Harding, gun maker, Great Queen Street, Lincoln's Inn, has patented a gun for sporting and military purposes, in which by a peculiar modification the power is very greatly increased: the powder in the patent gun is ignited backwards, and being thus completely consumed, exerts a far greater power than

when fired in the ordinary way. A gun on this principle will, at 40 yards, drive shot through 72 sheets of brown paper, while 40 sheets are regarded as the standard test of strength by the best makers of the present day. There are other minor advantages: a greatly increased quickness of firing, almost as marked over the present gun as between the percussion cap and the old flint and steel. Mr. Harding has adopted a new primer, which resting nearly direct upon the barrel removes a great fault of the present cap, the constant fracture of the nipple, from the continued percussion to which it is necessarily submitted, while the loading appears even more easy. We hope in our next number to lay before our readers the drawings of this important invention.

The patent Elastic Royal Albert Cravat, and Johnson's Flexible Hat.

These are two improvements upon the wearing apparel of the day which well deserve public approval. No part of the dress is of more importance to the healthy state of the human economy, for both mental and corporeal well-being materially depend upon them. Nothing could have been more absurd or more dangerous than the tightly pressing cravat which is now nearly abandoned by all sensible people. The manner in which the throat was encompassed by stocks and folds of linen prevented the due return of blood from the head, the consequence of which was, in many instances, not only giddiness, and impaired faculties, but even death. Those who remember the military costume a few years since, cannot be surprised at the frequent sudden deaths which took place after long continued parades.

The example of Lord Byron cannot be followed in this country, for such is our climate, that were a simple riband only worn, affections of the throat and glands, to which young people more especially are liable, would become very prevalent. It therefore is necessary, that something should be adopted possessing sufficient warmth, pliability, and lightness: all these the Albert Stock possesses. The frame of this useful cravat consists of two wires; they form the edges at the top and the bottom; these are united at the back by a spring, and when covered with a cool and light material, present a stock which, for comfort and for health, surpasses any thing we have yet seen: there is no pressure upon the throat, no restraint upon the free and easy motion of the head; in appearance it is elegant and tasteful. We are fully persuaded that those who have once been accustomed to the use of this elastic stock, will not exchange it for any thing that has yet been worn.

Johnson's patent elastic hat is another of those comfortable and useful arrangements which materially add to personal en-

joyment; there is no pressure upon the head, and the accumulation of perspiration and the condensation of the exudation are prevented. Its construction is peculiar, and it is speedily adapted to the form of the head, which it always retains. This is an improvement upon the hats now worn which well deserves the general patronage.

BOILERS FOR STEAM ENGINES.

M. Bevenot, a French chemist, has demonstrated, by a series of experiments, that he can prevent the formation of the calcareous and ferruginous crust which steam engenders upon the boilers of engines. His plans have met with the approbation of Brunel, of Cubitt, and of some of the first engineers.

THE SCIENTIFIC AMUSEMENTS OF LONDON.

By Zeta.

In every age of the world, and among all people, we find provision made for relaxation from the severer duties of life. Under the head of amusement, we might class an infinite number of customs and institutions, the chief feature, and indeed main essence of which is, that they embody in them a change from the common routine of things about us. Not any of these means of recreation contain in themselves the power of amusing, the power, that is, of irresistibly leading us to seek them out and seize on them, whenever we feel a need of or a wish for such a stimulus. They are in fact business or pleasure, according as we take them, or according to circumstances. This point is not badly illustrated by an incident, which is said to have occurred to some of our East India Company's officers; they are reported to have invited several persons of distinction in China to witness the gaieties of one of their balls; and, as a matter of course, they could not fail to ask their visitors their opinion of dancing. In all innocence, the Chinese replied in some such terms as these: "dancing is certainly very interesting and pleasing; but it must be very fatiguing; and we wonder that you do not *get your servants to do it for you*." But the moment a thing is done of necessity, that moment it ceases to be amusement; it must be a free and voluntary act, and with this condition, no matter how much labour it involves, no matter how much difficulty it presents, it is amusement. The artizan, who, after a week of toil, denies himself the privileged seventh day's rest, and imposes on himself the fatigue of dragging, some two or three children perhaps, in their little cart, along a hot and dusty road to some suburban resort, derives as much pleasure from this labour, as his more wealthy

fellow-countryman does in rolling round the park in his easy chariot. Indeed, it is a matter of very serious interest to notice the amount of pains-taking and fatigue, which we are willing to undergo voluntarily, in order to satisfy that peculiar craving of the human mind after variety. Very truly did the poet write—

> "Qui fit, Mæcenas, ut nemo, quam sibi sortem
> Seu ratio dederit, seu fors objecerit, illâ
> Contentus vivat: laudet diversa sequentes?
> O fortunati mercatores, gravis annis
> Miles ait, multo jam fractus membra labore.
> Contrà mercator, navim jactantibus Austris,
> Militia est potior. Quid enim? concurritur: horæ
> Momento cita mors venit, aut victoria læta.
> Agricolam laudat juris legumque peritus,
> Sub galli cantum consultor ubi ostia pulsat.
> Ille, datis vatibus, qui rure extractus in urbem est,
> Solos felices viventes clamat in urbe."

A popular commentary on this passage is that amusement is diverse from duty, that it is not inherent in the things which must come upon us, but is peculiar to those which we seek out for ourselves.

However, we must not go on philosophizing thus: our duty lies another way, and perhaps this very circumstance it is which has induced us to follow the bent of our inclination, and deviate, because it pleased us, from the path we have in view. It has seemed to us that we may contribute to the amusement of our readers, and instruct them the while, if we give occasional articles on some of the leading means of recreation which exist for the inhabitants of this great city. Of course the name of the amusements of this world of London is "Legion," some are of so pure a stamp as to be worthy the pursuit of the highest intellect, or the most spiritualized mind; others are of so base a nature as to be worthy only of "the beasts which perish." Not only are they as various as there are varieties in the human mind, but they are as endless as the phases of society, which are created by the artificial atmosphere in which we, in common with all civilized communities, have our being. Out of this comparative chaos, we cannot be expected to select more than a few leading types of certain classes of amusements. In illustration of some of the means of intellectual recreation, we intend saying a few words in the present paper, on the Scientific Amusements of London.

It is quite lawful to us to include under this term—indeed to place at the head of the group—the great corporate associations, ostensibly established, and extensively patronised and supported, for the advance of science generally, as in the case of the Royal Society, and certain branches of science only, as in the case of the Geographical, the Geological, the Antiquaries', and other similar societies. It is the custom with the Fellows

of these societies to meet at set times, to hear papers read, treating on some fitting and proper subject, the contribution of a Fellow, or of a stranger as proxy to a Fellow. They possess libraries, which are increased by purchases or contributions, the contents of which are readily accessible to Fellows under certain reasonable restrictions. Several bequests also exist among them, which are devoted to awarding as testimony of merit to successful aspirants after the honour. These societies are preserved in their integrity, and maintain their well-merited position, by the wholesome restrictions which exist in the mode of introduction and election. A gentleman wishing to join the Royal Society, for instance, is presumed to possess a knowledge of science, as well as a love for it; and in proposing himself as a Fellow, it is the custom that he should state the ground on which he claims to be received. His name and his claims are attested by the signatures of Fellows who have a personal knowledge of him, and others who have a general knowledge. In due time he is balloted for, and is considered blackballed unless he has two-thirds of the votes in his favour. On being elected, he takes an early opportunity of being presented by another Fellow to the President, or if it is so chosen, to the Vice-President. The right-hand of welcome is held out to him, and he is admitted to all the rights and privileges of the society. Certain fees are paid, and then the honour of F.R.S. is appended to his name. Some such forms prevail in the other societies.

A large section of the Fellows of these societies do little more than support the institution with their substance, and receive the publications: the actual working bees, so to call them, are comparatively few in number; and the zeal and industry of the working few (and such men are always found) give the more impetus to the society. When we call their work amusement to them, we must use this word in its highest sense. Their minds are stored with the truths of science, and it delights men freely to add their own contributions to the existing store, and to encourage and foster the cooperation of others, in assisting the onward progress of the branch of knowledge over which they preside. We have ourselves occasionally trod the threshold of experimental research, and have obtained a casual glance at the patience and anxiety of him who labours steadily and faithfully on in such a means of searching after truth; and are more than prepared to give him the highest honour; and acknowledge that to him is due the warmest expressions of gratitude from the whole civilized world. And when we do this, we barely fulfil our duty; for, after all, he has not one jot or one tittle more than is justly his due; for when he gives us a truth, which he obtained only at the expense of time, and talent, and zeal, a grateful recognition of the gift is the least we can bestow in return. But, besides these

men, who are in turns contributors to the store of knowledge, there are others who do not pretend to aspire to so high an honour, but content themselves with increasing their own knowledge from the truths thus presented to them; and perhaps with these we ought to join the great class of lovers of science generally, to whom these things are a source of much pleasure, as soon as they shall have reached them through the medium of the press.

One very important advantage connected with the periodical meetings of the societies, is the opportunity thus furnished of the reunion of men of science: they meet each other peculiarly in their own atmosphere, and, as iron sharpens iron, so does each feel his own appetite for what in his heart he loves, sharpened by what it feeds on; and he goes away, wound up, as it were, and actively disposed. The actual business details of the Royal Society are conducted by secretaries and a council, assisted by distinct committees from the various branches of physics. We might add, that communications to all the societies, when from a philosopher of established reputation, are readily and unhesitatingly received; for the position he occupies is the guarantee to their value; whereas a contribution from a "nero non" must needs be received with greater caution, because he has not yet put in that security which is attached to the other. It is well to mention this, because the zealous and the ardent are sometimes apt to look so affectionately on their own productions, as not in the least to undervalue them, and to think they are neglected, when really nothing more than lawful discretion has been exercised.

It will be seen from these few observations that new societies are designed, not as institutions to teach the elements of science, but as the head quarters around which they are to rally, who desire themselves to advance the progress, or to watch the advance of the science. But there is another class of institutions, in which science is converted into a less scientific form, if we may use the term; and its truths, elementary as well as advanced, are laid before us in a more popular manner. These are abundant among us, (each quarter of our London possessing one at least,) under the name of Literary and Scientific Institutions, and occasionally Mechanics' Institutions. At the head of these may be placed the Royal Institution, and the London Institution. At these places short courses of lectures are delivered during the season, on selected subjects, by well qualified professors and lecturers. These lectures embody the fundamental principles of the subject at issue, and are invariably connected with all the recent acquisitions of importance. There are also evening meetings every Friday during the season, at the Royal Institution, at which things new or curious in art or science are exhibited; and isolated lectures on prominent features of recent research, or on subjects of general

interest, are delivered. A few soirées of a similar kind are held at the London Institution. The latter place has an advantage for this purpose, over the former, in its capacious library, which affords ample accommodation to the members. In both places the lover of intellectual pursuits is sure of meeting kindred spirits; and has there an opportunity of coming into frequent contact with his "set,"—and, be it said with humility, with the "set," many individuals of which do honour to their name and nature. Each institution is in possession of a valuable library; that of the London, is, we believe, especially valuable for reference. The Royal Institution has a very good collection of philosophical instruments, many of which are of peculiar interest, in consequence of their connexion with the important researches of Davy, Wollaston, and Faraday; it has also a museum. We can scarcely include the class lectures on chemistry, that are delivered at nine in the morning, in the laboratory of the Royal Institution, as being among the scientific amusements; for they are now of a private nature, and are chiefly intended for medical students; they are delivered by the professor of chemistry, three times a week, from October to May; and are perfectly illustrated throughout. The fee for the course is very reasonable; there is a laboratory at the London Institution, but it is not much used at the present moment.

Some such arrangements as the above prevail, more or less modified, at the other literary institutions. In many there are bonâ fide classes for the study of languages, music, and other branches of knowledge, and the majority possess a lending library. The style of the lectures varies according to the resources of the individual institution, and the caste and character of the class constituting the members. We may just mention here that a sort of literary institution has lately been founded, which is popularly known as the Buckingham Institution; it resembles the other institutions in a few of its features, but is intended to be more comprehensive,—to afford facilities for strangers and sojourners in London to meet the literary world; and it also offers to its members the advantages of a club. It has scarcely yet had time to settle into a fixed position, or to present its distinctive features.

We now come to what may really be called "the Popular Scientific Exhibitions of London,"—the places in fact which furnish the great mass of the public with demonstrations of science. The other institutions are in a manner exclusive: membership, or the introduction of a member, is, with a few exceptions, imperative on those who would be present. The exceptions are in the institutions where single tickets are sold for single lectures. But the exhibitions now before us, viz. the Adelaide Gallery, and the Polytechnic Institution, are accessible to all who proffer their shilling at the door; and we venture to say that these two institutions have played an im-

portant part in diffusing among the middle, and even the working classes, that better knowledge of natural phenomena, which is fast spreading among us, and that taste for physical philosophy which is becoming so general. The institutions being professedly places of amusement, although the amusement is of the best kind, are peculiarly concerned in the present observations.

The Adelaide Gallery.—This, being the elder sister, merits our first attention. It was established several years ago "for the Encouragement of Practical Science;" it existed in embryo in the Royal Mews, then occupying the spot on which the National Gallery now stands; and was soon matured and transferred to the building it now occupies in Adelaide Street. Looking back to its very earliest days, we remember to have derived our first ideas of many things from within its walls; we saw there apparatus, and instruments, and models, which served to direct our thoughts into new channels, and paved the way to the acquisition of a clearer insight into the several natural phenomena, which were there presented to us for the first time. There were daily lectures and popular illustrations of science, exhibitions of the secrets which the microscope reveals, weaving, glass-blowing, mechanical illustrations, collections of models, and inventions innumerable; and, in short, there was work for several days to those who desired to see all that was to be seen. New inventions and discoveries were constantly to be seen; and the public seemed, as it were, waked out of a dream, and placed where they might see with their eyes those things of which the larger mass had not even a book knowledge before. Our fathers were left quite in the rear, when this new fountain of knowledge was opened to us, their children; we took some ideas in our young minds which the cares, the business, and the pleasures of the old school did not permit them to receive; and we acquired thus a new and heretofore unknown source of enjoyment. In these observations we are not carried away, be it remembered, by the imagination, but are detailing the actual facts, and are willing to acknowledge that the Adelaide Gallery has been the source of a vast amount of good; it has set machinery in motion, the effect of which will be felt till time shall be no more,—long after itself shall be dead and forgotten. We fear that it has already seen its best days; it no longer monopolizes the name of the Gallery of "Practical Science;" it has sadly fallen from its first estate. The light of science has not, indeed, quite expired within its walls; but it has long burned very dimly, if it is not assuredly placed quite in the back ground. Let any stranger read a handbill or an advertisement of the present day, and he will not fail to conceive it to be a mere concert room. In place of putting forth prominently the subjects for which it was originally founded, the leading attraction now is a concert of vocal and

instrumental music. The very place itself has a tinge of the theatre about it: the last time we were there, we were pained at seeing how altered it was from its original purpose; scarcely had we entered, when the feeling of being in a theatre came over us; for we were importuned, in the well known accent, to "buy a bill of the concert." We found the system of reserved seats and private boxes introduced,—to which we much object. We listened to the said concert, and were displeased at hearing a man screaming out what he was pleased to call a "comic song." To crown all, on our exit, we complied with what appeared to be the custom, by giving the attendant a few pence for taking care of our canes. The science which filled up the intervals of the evening was diversified by importunate invitations to "go round to the left and up stairs to see the industrious fleas." We are not writing this with the least feeling of ill-nature; we are rather grieved to see the much altered condition into which this still valuable institution has fallen. We have no fault to find with the music or singing; for aught we know, the concert may have been very good or very bad; but we have always fancied that M. Jullien provides us with a better shilling's worth of music than did the managers of the Adelaide Gallery. Of the objects exhibited many are most interesting.

A few years since, the scientific world was electrified by the announcement of a discovery in France, having for its object the fixation of the images of the camera obscura, and we were charmed by the beauty and accuracy of the products of this new art, as exemplified in views of buildings, landscapes, &c., formed by its means. Five years have passed away since Monsieur Daguerre made known to the world his famous discovery, but during this period what changes have taken place, what improvements have been effected in this extraordinary process! Let us compare one of the early landscapes of Daguerre with one of the admirable pictures produced daily in the studio of M. Claudet. How striking is the difference! In the former we have, it is true, a perfect delineation of nature traced by her own hand, and given with the most perfect exactness, but hard, ineffective and indistinct; in the latter, on the contrary, we are struck with the strong evidence of reality which it bears. The instantaneous operation has caught the changeful expression of the countenance, a smile is just playing over the features, and nothing can surpass the pictorial effect of the whole. Whence comes this great difference between the two? It is from the fact that the latter plate has been prepared by an improved chemical means, which has rendered it perhaps a hundred times more sensitive to light than that upon the surface of which the landscape was taken, and it is only by this rapid operation that perfectly good specimens of the art can ever

be produced. If the time necessary for the sitting be lengthened, the countenance loses its vivacity, and the semblance of life is gone; the features are fixed and stolid, and the animation, which lends a charm to the face, is wanting. So is it also with the sister art, the calotype; hitherto the great time required to produce the desired effect has prevented its application to portraiture to any great extent; but it is gratifying to know that this process has at length been placed in the hands of one skilful enough to show of what it is capable, and of effecting those improvements of which it is no doubt susceptible. It is to Monsieur Claudet that we allude, he having lately commenced the exercise of the art of calotype in conjunction with the Daguerreotype, and doubtless he will shortly give a new position to it, by the same perseverance and talent which has enabled him to make such striking improvements in the process which he already practises with such great success.

The Polytechnic Institution.—The principle of this Institution is mainly the same as that on which the other was based. It was opened a few years later, and has advanced in reputation rather than otherwise. On entering, the visitor passes through what is called the hall of manufactures, in which are seen the processes of braiding, ivory-turning, printing by steam, and other mechanical operations, besides a steam-engine of a peculiar construction. Beneath this hall is a laboratory, fitted up with all the requisites, which is open to pupils, and in which chemical analyses are performed. From the entrance hall a flight of steps leads to the gallery of the great hall, in which are models and specimens, too numerous to mention. Immediately at the entrance is a barometer in constant action: by this instrument the direction and force of the wind and the quantity of rain are regularly registered. The lower floor of this hall is furnished with a tank and canals; a diving-bell, capable of accommodating five or six persons, descends in the former, several times a day. The canals are connected with miniature dockyards, to illustrate the art of ship-building, and they terminate in a regular system of locks. Many philosophical and mechanical discoveries are daily illustrated in this part of the building. Beyond is a lecture-room, in which popular lectures on chemistry and on natural philosophy are delivered every day by the professors of those two sciences. Still further are other apartments, where modelling and glass making are shewn. Here is seen a very valuable and accurate model of the under cliff of the Isle of Wight, constructed by Captain Ibbetson, in which every inch is laid down from a trigonometrical survey that occupied five or six years. Other rooms are devoted to the processes of Daguerreotype and Kalotype, and to chemical classes. Over the entrance hall already mentioned is the large lecture

theatre, in which the colossal electrical machine, worked by the steam engine, used to be described, but which now contains the still more powerful source of electricity, Armstrong's hydro-electric machine. Here also are shewn the dissolving views and the microscopes.

The management of this Institution is under a board of directors, who meet once a week, and a secretary, who is there daily; it maintains its position as a scientific institution, and prospers in a financial point of view. The lecturers are efficient and very useful men, and are in good esteem with the public; they introduce as much as they can of new discoveries into their respective daily lectures. There is a band, which plays during a part of the day and evening, in the intervals between the lectures or other *vivâ voce* illustrations, and during the exhibition of the dissolving views.

We should mention that, during the last few weeks, a series of musical lectures have been delivered. The very announcement of them alarmed us. Had we influence with the powers that be, our protest would be given against them, for the music is the main attraction of such lectures, and they virtually become a concert. The Adelaide Gallery has already taken up the ground, and the lectures on music have been admirably delivered there. Our advice would be, that the attempt at musical lectures be terminated as soon as possible, to be no more resumed. The better portion of the patrons of the Institution, we are sure, will think with us.

There is one circumstance which has often struck us in connexion with this Institution; it is, the extremely difficult position in which the lecturer is placed. He has before him an audience, of whom the few come to hear and to be instructed; the larger portion to look about and to be amused; and he has thus to use the utmost circumspection, if he wishes to send all away satisfied. This leads him, frequently against his will, to introduce brilliant and, as they are termed, popular experiments, in order to rivet the attention by captivating the eye. The annoyance to the lecturer personally is, that he cannot do this to any extent without the fear of degenerating from a philosopher into a mere showman; and this he must avoid by every means, both for his own sake and that of his auditors.

We must not imagine that, even with all these aids, science has become fully infused into us; we have only to look around into our own little circle for full evidence to the contrary. We shall find that, with a few exceptions, the chief evidence that is prominent is the possession, by some about us, of a few heterogeneous facts, and an occasional piece of technical phraseology. In ordinary society we cannot get up a conversation on science; but we are not, on this account, to turn round and say that these institutions fail in their intent. The *ancien regime* is not yet worn away; these are all new things in our education, and

they are giving an impulse and a direction to our thoughts, which will lead to their full results in the race who are rising among these advantages. People are beginning—though only beginning—to recognize scientific knowledge as part and parcel of a regular system of education;—physics is entering our schools. Only a few days ago we saw a seminary for youth emblazoned as "a commercial and philosophical academy." Let time have its course, and the day will come ere long, when the leading facts of natural philosophy will be "familiar to our tongues as household words," and we shall not merely comply with the laws of physics, as we ever must do in all the ordinary duties of life, but we shall know the laws that we so implicitly obey. The why and the wherefore of things will be continually present in their progress, and we shall not run on hap-hazard, as heretofore, because our fathers have done so before us, but shall have our eyes open, and so see the right and the wrong at a glance, and have power to pursue either.

Z.

THE ROYAL BOTANICAL SOCIETY,

REGENT'S PARK.

THE last flower show for the present season, was held in the Society's Garden, on July 2nd, and like the two previous ones, the day was remarkably fine. The weather, indeed, on each of the three occasions, was all that could be desired: without being oppressively hot, the sun shone delightfully, from the time the company entered the garden till the close of the day.

In taking a retrospective view of this Society's fêtes for the season, which has now closed, it is impossible that the committee of management should not feel, in a very high degree, gratified with the success which has attended the general result of their labours, in the carrying out of these very agreeable and instructive exhibitions. On each of the three shows, the vast and capacious tents were unequal to contain the whole of the plants which were forwarded for exhibition. The company which visited the grounds to view these gay floral scenes, were the very élite of fashion, including her Most Gracious Majesty and Prince Albert.

The following are some of the more remarkable exhibitions, with a general notice of the most particular plants deserving of especial commendation.

This magnificent assemblage included two miscellaneous collections of 40 stove and greenhouse plants; five collections of 20 plants; three collections of 10 plants; two large collections of melocacti; five collections of 12 fuchsias; five collections of 12 pelargoniums; two collections of eight pelar-

goniums; two collections of eight calceolarias; six collections of 12 cut blooms of moss roses; thirteen collections of cut blooms of summer roses; two collections of cut verbenas; three collections of carnations; five of picotees; four of pinks; three of panzies; two collections of roses in pots; six collections of 15 Cape heaths; four collections of six Cape heaths; two collections of six orchidaceous plants; two collections of British ferns; and numerous other less prominent collections, specimen plants, and seedling varieties of florists' flowers.

Mr. Barnes, as on the previous occasion, received the first prize, for a collection of 40 plants, of great beauty, and evincing extraordinary skill in their cultivation. To describe individually so large a number of plants would be impracticable, and we must therefore content ourselves with noticing a few of the most prominent: there were Phenocoma prolifera, a dense bulb three feet in diameter, studded with numerous brilliant crimson "everlasting flowers;" there were besides, plants of different species of Aphelexis, rivalling the former in their promise of *enduring* brilliancy. Aerides odorata, had three spikes of its deliciously fragrant white and pink flowers; and Clerodendron squamatum and C. paniculatum, with their crimson panicles of Azalea-like blossoms, elevated above their ponderous foliage, imparted grandeur and magnificence to the beauteous and odorous assemblage.

Mr. Hunt obtained the second prize; his collection included a large Achimenes longiflora, literally covered with blue conspicuous flowers, and thus mantling its verdant foliage with a covering of the deepest azure. Ixora coccinea, with its clusters of scarlet flowers, and shining laurel-like ample leaves, "stood nobly forth;" and Clerodendron too, was even finer here than in Mr. Barnes's collection; it was crowned with five panicles of bloom.

Mr. Bruce, of Tooting, obtained the highest prize for a collection of 20 plants; he too had "everlasting flowers" in great beauty; and Pimelia decussata, with box-like leaves, and heads of pink flowers, with Erica gemmifera, and Erica tricolor, was in great beauty. Mr. Baker had the second prize for a collection, including Dracophyllum gracile, with pure white flowers; Sollya linearis, with deep blue "bells" hanging gracefully on their slender stalks; and large plants of Erica ventricosa superba, and E. ventricosa stellata, with wax-like flowers, in countless numbers. Mr. Green had, among others, a very large specimen of the graceful Coleonema pulchra, with heath-like foliage, and pretty pink blossoms. Mr. Fraser's collection included many old favourites, in a fine state, such as Crowea saliqua, Crassula coccinea, Vinca rosea, and V. rosea alba, and many others. Mr. Pawley, in his collection, had Cattleya Mossiæ superba, with seven splendid blooms open; and a large plant of the noble climbing plant Stephanotis floribundus, with

clusters of white scented flowers; Oncidium flexuosum, Leschenaultia formosa, and Sinningia Hallerii, var. Macrantha, in the same collection, were particularly fine.

Mr. May was most successful in the competition of 10 plants. Ixora coccinea, with fifteen heads of flowers, was a perfect picture; and several heaths were remarkably fine. Mr. Stowe brought an excellent Erica depressa, or more properly *E. nana*, with tubular yellow flowers, and a dwarf bushy habit of growth. Mr. Taylor, among other good plants, had the old Swainsonia galegifolia, and Mahernia incisa, well grown and in fine bloom.

A collection of creepers from Mr. Fraser, were specially admirable as a group; this *effect* is mainly attributable to the pillar like, almost cylindrical trellises on which they were trained, these being perfectly simple and elegant when viewed individually, and perfectly consistent and harmonious taken collectively.

New or rare single specimen plants were abundant. Mr. May had the first prize for a splendid Erica jasminiflora alba. Messrs. Lucombe and Co. had an extra fine plant of Statice macrophylla. Mr. Dobson's Achimenes grandiflora was truly beautiful. Of new plants, Messrs. Lucombe contributed Cyrtoceros reflexum, a plant with broad shining leaves, and clusters of wax-like, star-shaped flowers; Ixora acuminata, also bearing large heads of showy white blossoms; and Cuphea strigillosa, with cordate leaves, and red and green flowers.

The collections of Melocacti attracted much attention from the company; the curious and grotesque forms of some, and the numerous coloured thorns bespangled over them, and glittering with every sudden ray of light, and the hair-like covering resembling the token of " hoar age," which mantled others, did not fail to secure both the attention and admiration of the visitors.

Fuchsias were in full bloom, but, alas! the new varieties, so much talked of and so much praised, are not by any means equal in merit to much older but now neglected kinds: large leaves, and coarse-looking dull coloured flowers, are the characteristics of too many of the recent hybrids. Mr. Gains obtained the first prize for these. Mr. Ayres had a collection of Scarlet Pelargoniums, consisting principally of a seedling variety of a dwarf growth, named " General Tom Thumb."

The Pelargoniums were very fine, notwithstanding the advanced season. Among amateurs, Mr. Dobson had the first premium, for the following varieties; Erectum, Luna, Matilda, Angiola, Dido, Leonora, Bella, Meteor, Lucy, Lord Chancellor, Flora, and Cleopatra. Mr. Gains, among nurserymen, was placed first; he showed:—The Cid, Antiope, Sirius, Amaranth, Cyrus, Madeline, Lady Isabella Douglas, Amethyst, Alba Perfecta, Una, Mabel, and Grand Duke. The other collections exhibited were scarcely inferior to these. Seedling Pelar-

goniums are not generally possessed of any remarkable merit: Mr. Beck's "Aurora," and Mr. Silverlock's "Emperor Nicholas," were selected for prizes; and certificates of merit were given to Mr. Staines's "La Polka;" and to Messrs. Henderson's "Lady Peel." Mr. Beck exhibited "Igniferum," in a class provided for those which in colour approached nearest to the old fashioned scarlet geraniums, to which the prize was awarded on that ground. A seedling Scarlet Pelargonium, named Antagonist, and a seedling Fuchsia, named Highland Chief; the former from Mr. Diplock, the latter from Mr. Hally, were also rewarded. A very pretty seedling Heath, named Erica tricolor pallida, was exhibited by Mr. Burley, and received the first prize in its class.

Roses in pots were in small numbers, but very good in quality; Messrs. Lane and Son, and Mr. Dobson, were the competitors.

The most strikingly beautiful and numerous family in the exhibition was the Heaths, and these were models of the most perfect cultivation; so much so, as to render it invidious to attempt to particularize; we shall, therefore, mention the varieties included in Mr. May's collection, to which the first prize was assigned:—E. depressa, or nana, E. Parmentieria rosea, E. radiata, E. Massonii, E. princeps, E. Savileana, E. tricolor elegans, E. Irbyana, E. jubata, E. ventricosa superba, E. comosa alba, E. densa, E. viridescens, E. tricolor, and E. odorata. Collections of fifteen kinds, were shown also by Mr. Barnes, Mr. Jackson, Mr. Pawley, and Miss Fairbairn. Collections of six kinds were shown by Mr. Hunt, who gained the first prize, with E. Massonii, E. gemmifera, E. Cavendishii, E. tricolor superba, E. tricolor var., and E. Westphalingia, by Mr. Taylor, Mr. Dawson, and Mr. Fraser.

A prize was offered for a device in cut flowers, intended to represent the grouping and arranging of colours in ornamental flower gardening. Mr. Ayres gained this prize for a design which attracted much attention; the principle on which the design was executed was that of contrast.

The Orchidaceæ, though limited in number, yet contained some fine grown specimens. Mr. Hunt gained the first prize, with Cattleya crispa, C. Loddigesii, C. Mossiæ, Oncidium luridum guttatum, Vanda Roxburghii, and Dendrobium chrysanthum, all in very good condition. G. F. Cox, Esq., exhibited Stanhopea insignis, Miltonia spectabilis, well grown, and the rare Denbrobium aduncum, with some others. A collection from Mr. Barnes included Aerides odorata and Myanthus barbatus.

The collections of British Ferns again called forth the admiration of the visitors, as on former occasions. The two collections exhibited were both in exceedingly fine condition, and both were rich in the rare and delicate species. Among those brought by Mr. Smith, was one with very curiously divided

and curled fronds, somewhat resembling curled parsley ; this is said to be a variety of Asplenium Felix fœmina, the beautiful and graceful Female Fern (as it is familiarly termed).

A collection of dried specimens of cultivated varieties of grain, exhibited by Mr. T. Moore, attracted much observation.

Other miscellaneous subjects were a seedling Mimulus, named splendens, from Mr. Bunney; a seedling Pink, called Favorite, from Messrs. Brown and Ottwell; a seedling Petunia, Sorrell's Essex Magnum Bonum, from Messrs. Sorrell; a collection of hardy fruits from Mr. T. Bursill; and a collection of cut seedling Pelargoniums, from Messrs. Lucombe and Co., all of which obtained extra prizes.

Cut Roses always form objects of attraction at Horticultural exhibitions, when they are present; and it was so in this instance; the display was enormously extensive, and the interest of the company unabated up to the close of the exhibition. Messrs. Lane and Son were the winners of the first prize in the Nurseryman's Class, and Mr. Milne, among the amateurs: Mr. Betteridge taking the first prize for Moss Roses, among the amateurs.

The florists' flowers, including Carnations, Picotees, Pinks, Panzies, and Verbenas, were severally very good; and afforded much gratification to the respective fanciers of each.

We must not omit to mention the excellent collection of Achimenes, from Mr. Dobson; of Clerodendrons, from Mr. Barnes; of Statices, from Mr. Taylor; and of Alpine plants from Mr. Wood: nor yet must we forget a curious specimen of Cereus monstrosus, from Mr. Bunney,—monstrous indeed, looking more like little mountains of vegetable tissue confusedly amalgamated, than like an organized living plant.

The number of prizes which were distributed to the successful competitors by the judges, on this occasion, was 98.

PUBLIC AMUSEMENTS.

THEATRES—SHAKESPEARIAN READINGS.—CONCERTS.

The bow, to retain its elasticity, needs to be occasionally relaxed; and the mind, to preserve the healthful vigour of its faculties, needs the stimulus of recreation. Happy, then, are they who live in the heart of this great metropolis, and who have the means and opportunity of enjoying the amusements so abundantly provided for them, both in public and private life. The sports and pastimes of a people are always indicative of their intellectual and social condition. The festivals of Greece, the gladiatorial exhibitions of Rome, the bull fights of Spain, are significant of the peculiar character of the age and nation. Upon the same principle, the public amusements of London indicate the existing tone of society, and the character of its intellectual resources. They vary, and it is to be hoped im-

prove, every successive season; they deserve, therefore, always a passing notice, as chronicling the form and fashion and spirit of the age.

With the fashionable season many of these amusements cease, and we have such recreations in the open air as our uncertain climate permits us to enjoy. The Opera, the Haymarket, the Princess's, are under their respective managements preparing for fresh sources of attraction in their due course. We have now only to record the last enjoyments which closed the season.

QUEEN'S CONCERT ROOM, HANOVER SQUARE.—M. ERNST'S MORNING CONCERT.

This concert served to exhibit the talents of M. Ernst in a variety of forms. His occasional appearances at the concerts of other artists, afford but inadequate scope for the display of his great talents. In the present instance, he presented himself, in conjunction with others, as the interpreter of the ideas of Mendelssohn and Beethoven, as well as the utterer of his own inspirations. The quartett in E minor of Mendelssohn, is a severe trial to the performer—the extraordinary rapidity and *simultaneity* (if we may coin the word) of this author's thoughts, render his works inaccessible, except to the gifted few. There manual dexterity will not avail, as in the case of the Lizsto-Thalbergo-Döhleric school—there must be a vivid apprehension and comprehension of the author's mind, combined with a self-possession upon the instrument, and a most perfect command of its resources. In all these particulars Ernst (ably seconded by Goffrie, Hill, and Hausmann) must have satisfied even the fastidious composer himself, as much as he enraptured the body of his auditors. The *Scherzo*, in which class of movement this writer stands unrivalled, was clamorously encored. Of Miss Dolby, we regret to say, that we observe the mechanism of art, without the graces which should conceal it. Her readings are dull, cold, and apathetic. We entreat her attention to the voice of a criticism which is reluctantly uttered, under the impression that the praises of certain coteries are leading her into a treacherous belief that she has accomplished all that she is capable of attaining. In her case, as also in Staudigl's, the applause came from the lower end of the room: this may exhibit the zeal of friendship, but it may as clearly reveal the "eye to business." To return to M. Ernst's own performances: besides the quartett of Mendelssohn, he took part in the Kreutzer sonata of Beethoven, in which he and Moscheles vied with each other in rendering perfect the developement of this fine work. Perhaps no more judicious selection of works could have been made by M. Ernst for the display of his varied skill. The transition from the playful complexity of Mendelssohn, to the stern, determinate simplicity of Beethoven, con-

trasting with his own compositions, in which he poured forth all the riches of his peculiar style. In the triple concert of Bach, for three pianofortes, Moscheles, Mendelssohn, and Döhler rendered homage to the bold and massive conceptions of their author. The *cadenza* of Moscheles was a masterpiece, both in design and execution. What a contrast did it present to the flimsy and common-place exhibition of Döhler! We were at once pleased and disappointed by Mendelssohn's modesty, which prompted him to leave the laurels of this part of the performance upon the brow of Moscheles. The *wonder* of the day was M. Ernst's performance of Schubert's ballad "the Erl King," transcribed for the violin alone. The air, surrounded by its rushing accompaniment, now wailing, now consoling, now luring, and lastly falling into the accents of hopeless sorrow, carried away the hearers into the fullest sympathy with the subject—a sympathy so deep, pent up with a wonder so overwhelming, that some seconds elapsed before the thunders of admiration could burst forth. Great as had been the displays of this "master's" magic control of his instrument, this performance swallowed up the memory of them all. Those who heard it can never forget it—they who did not, can have but a faint conception of the powers of M. Ernst.

THE ROYAL AMPHITHEATRE.

Our youthful friends have had every reason to be delighted with the pains taken by Mr. Batty to enliven their holidays. Equestrian spectacles are to them sources of peculiar gratification, and ample has been the opportunity afforded them of enjoyment. The last, and a very successful novelty too, has been a drama founded upon our African expeditions, and the ferocity of the wild monarchs of the forest, affording Carter an admirable opportunity, of which he splendidly availed himself, of demonstrating the power he has acquired over the most ferocious animals.

ST. JAMES'S THEATRE.—BRAHAM'S CONCERT.

Braham, our greatest English vocalist, with unimpaired energy, sustains his acknowledged reputation: another concert, aided by the performance of an amateur company of performers, gave him and his sons ample opportunity of displaying those remarkable talents which deserve public encouragement. The striking feature of the evening was "The Bay of Biscay," given with all that dramatic effect and "soul of song" which have placed Braham far above all competitors.

THE LYCEUM.

Mr. and Mrs. Keeley continue to find out and to please the public taste. Aladdin, in the shape of a melo-dramatic burlesque, has, as it well deserves, been a favourite with the play-goers, and the best eulogies are the crowds which nightly fill the house.

OBSERVATIONS ON CAPTAIN WARNER'S INVENTION.

By Colonel G. F. Herman.

"Nec credo nec sperno."

A philosophical writer of the present age has observed, that every grand climacteric of the world has been ushered in by some new discovery or invention. Thus gunpowder broke the barbed ranks of the feudal aristocracy, and changed the whole system of war. Printing sapped the foundations of the Romish Church, and extended the domain of thought. The mariner's compass and the genius of Columbus discovered the new continent of America. In the present age, the rapid and prodigious development of physical and mechanical science bids fair to reconstruct society upon an entirely new basis, and by the application of its wonderful discoveries to the art of war, to exercise a singular influence on the destinies of the human race.

Of the balistics and pyrotechny of the ancients, we know comparatively but little. Vegetius tells us that, with the balista, they could project a stone of 250 lbs. weight to a distance of 300 to 400 yards. But as we are unacquainted with the initial velocity of this projectile, no just idea can be formed of its tactical effect. The highest result of their pyrotechny was the celebrated Greek fire, which, on its first trial off Cysicus, in the Propontis, destroyed a Saracen fleet and 30,000 men. Preserved as a state secret during many centuries, it perished in the destruction of the lower empire. In the reign of Louis XV., a Frenchman of the name of Dupré, rediscovered the Greek fire, or at least some preparation analogous to it. The secret, purchased by the monarch, was not however suppressed by him, as it has been generally represented; on the contrary, every document connected with it was in the possession of Napoleon, and from its nonapplication by him to the operations of the field, we may infer that he considered its tactical effects inferior to that of gunpowder. Of the dynamical power of gunpowder, from the extreme divergency between the experiments and the calculations made on the subject, we know little more than was known on the day of its discovery.

John Bernouilli has advanced that the elasticity of vapour produced by ignited gunpowder, equals at least 100 times the pressure of the atmosphere; Daniel Bernouilli, 10,000 times this pressure; Robins, 1,000; Hutton, 2,000; Gay de Vernon, 80,000. Euler, Romford, Belidor, and others, devoted much time to the investigation of its properties, and with equally different results; and for this very simple reason, that they sought to indicate the absolute force of gunpowder, instead of deter-

mining the elasticity of the gas it produces, according to its quantity and quality, the arm, the space that contained it, the state of the atmosphere, and an infinity of other circumstances, to which too much attention cannot be paid.

Neither, considering the time that has elapsed, (until very lately,) has any material improvement or advance been made in artillery or military pyrotechny. Probably in no other branch of science has the *esprit de routine* been more fatal to improvements than in that of artillery. Thus, although mortars were invented in 1434, they were not used till upwards of a century afterwards. Again, in 1775, the possibility of obtaining, with a ten-inch shell, a range of 3,000 yards, was disputed. In 1810, Col. Wellamtrois, at the siege of Cadiz, with his mortars, one of which may be seen in St. James's Park, obtained a range of 6,000. But a still more striking illustration of the slow progress of artillery science is this: it was only in 1770 that, *by chance*, was discovered the fact, that in mortar firing, the fuse of the shell was ignited by the ignition of the charge. Up to that period, mortar firing was termed *le feu à deux tirs*, because the fuse of the shell was ignited before the match was applied to the charge. Notwithstanding this discovery, nearly thirty years elapsed before any practical result was derived from it, until the genius of Paixhans saw that, by elongating the piece, shells might be projected horizontally, to which we owe his *cannon obussier*[a], the greatest result of artillery science.

Various experiments have been made to increase the explosive force of gunpowder, but independently of the dangers arising from the extreme susceptibility of the various preparations discovered, it has been found, that our ordinary artillery can scarce resist the explosive power of common gunpowder; and therefore, unless some new metal or metallic composition were discovered, possessing greater powers of resistance than brass or iron, the application of these preparations would be impossible.

From the great progress that has been made in chemical science, it may be doubted if gunpowder be the last chapter in the Pyro-Balistic art. A commission of French engineer and artillery officers, in 1839, pronounced that we are on the eve of discovering some new power that will supersede its use. Captain Warner's late experiment, at Brighton, has certainly gone far to confirm this opinion.

Of the experiment in question, we know nothing beyond its terrific results. The composition of the power used, its mode of application, are as yet perfect mysteries. From the correspondence laid before parliament, all that we can gather is this: first, that it may be used subaqueously; and secondly, as a

[a] It was also in 1792 that field artillery was only introduced in the French armies.

projectile, to which the extraordinary range of six miles may be given!

Now the powerful effects of a small quantity of powder employed in mines, petards, and hollow projectiles, suggested the idea of adopting similar processes for the destruction of ships. Hence the invention of torpedoes, by Fulton and others, both for offensive and defensive operations. In 1810, a French artillery officer proposed to defend the harbours of France, by means of a chain of torpedoes sunk at their mouth, and which he asserted would destroy any attacking force. A model of this machine is preserved in the Musée de l'Artillérie, at Paris. Its mechanism was of the most ingenious construction, and calculated to yield only to a pressure equal to that of a ship.

In many of its details, this system of defence is similar to that proposed by Captain Warner for blockading an enemy's fleet. Both are open to the same objection, which is simply this, that these torpedoes, when once placed in position, would be perfectly harmless so long as the enemy did not move. Again, what could prevent them, by means of divers or the diving bell, from discovering the position of these subaqueous mines, and consequently, by a very simple process, from defeating their objects? Struck with the advantages to be derived from projectiles of this description, General Paixhans proposed to give to a torpedo the form of a boat, and by means of a large rocket to direct its movements. A very simple mechanism ignited the charge on its coming in contact with its object. After several trials, the result confirmed the profound observation of le Mareschal de St. Cyr — "que toutes les difficultés de la guerre consistent dans leur application." From the foregoing observations it must be evident that the value of Captain Warner's invention consists in its projectile powers. If the susceptibility of the preparation he uses will admit of its projection with the same impunity as that of every other projectile at present in use, and at only the ordinary artillery range, it will revolutionize the whole system of modern war. Napoleon has observed, "que la force d'une armée, comme la quantité des mouvemens dans la mécanique, s'evalue par la masse multipliée par la vitesse. Une marche rapide augmente le moral de l'armée—elle accroit ses moyens de victoire."

The application of gunpowder to the science of war, has greatly diminished the mobility of modern armies, compared with those of antiquity [a]. States are now-a-days no longer overrun at a gallop, à la Tamerlane. War has become methodical; the obvious consequence of the principle of a *base*. In marching to the conquest of a country, an army requires every five or six marches a strong place, or a fortified position, on its line of

[a] To convey a just idea of the causes that so impair the mobility of modern armies, it would be necessary to go into the whole detail of their system of

operations, for the purpose of establishing its magazines, and organizing its convoys; in fact, a central point of movement to shorten the line of operations; for if the communications by which the army draws all its supplies, be not secure, it will be soon compelled to fall back. The expeditions of Crassus of and Julian in ancient times, Charles the XIIth in Sweden, Napoleon in Russia, and the more recent example of our own armies beyond the Indus, have proved that this fundamental principle of war is not to be violated with impunity. In the present constitution of modern armies, their pressure, therefore, like the other effects of nature, diminishes in inverse ratio to the square of the distance; in other words, to the length of the line of operation.

The invention of gunpowder has not only impaired the mobility of armies, but has likewise rendered their tactics much less decisive than those of the ancients. Hannibal, at Cannæ, destroyed 40,000 Romans in four hours. At Leipzig, after two days' hard fighting, the allies had 42,000 men hors de combat. The French artillery fired 185,000 rounds, and allowing only 120 rounds per man, in the two days, for the fire of their infantry, the result will be as follows:

Artillery	185,000
130,000 infantry, at 120 rounds	15,600,000
	15,785,000

Which gives approximately 400 rounds for each man put hors de combat. It is in siege operations that the application of gunpowder has given so decided a superiority to modern armies over those of antiquity. The science of Vauban has reduced the attack of fortified places to a matter of calculation. When the defences are merely artificial, he estimates thirty-five days as the maximum duration of a siege, provided the attack be made according to the rules of art. The effects of a mere bombardment are not, however, so disastrous as is generally supposed.

transport, which would far exceed the limits and objects of this paper. From the following state of the materiel of the French field batteries, some approximate idea may be formed on the subject.

Battery.				
12 pounder	6 guns	18 caissons	2400 rounds	108 horses.
8 ,,	6 ,,	12 ,,	2400 ,,	84 ,,
6 ,,	6 ,,	6 ,,	2400 ,,	48 ,,
Howitzer Battery 6 inch . . .	6 ,,	18 ,,	3000 ,,	108 ,,

The ordonnances of the French artillery give 400 rounds as the complement of each gun, and 500 for each howitzer, a complement sufficient for two battles.

At the battle of Leipzig, the allies brought 1300 and the French 700 guns into the field. In two days the latter fired 185,000 rounds. On the evening of the second day, when it was reported to Napoleon that the artillery caissons were nearly exhausted, he pointed mournfully in the direction of Erfurth, his nearest grand depôt, and exclaimed, "Avec 30,000 coups des plus je serois demain le maître de l'Europe.

Napoleon invaded Russia with 1200 guns, not including his *par cs de reserve* or *de siège*.

In 1694, the French threw 3000 shells and 1200 red-hot shot into Brussels without any material result. In 1757, Frederick, after bombarding Prague for 22 days, was compelled to retire. In 1782, two others equally failed. In 1792, the Duke of Saxe-Taschen, in six days, threw 36,000 projectiles into Lille, and without success. Landau stood a bombardment of 80 days; and during the war of the French revolution, Pichegrue threw 600 shells and red-hot shot into Manheim in ten hours. At St. Jean d'Acre, notwithstanding the rapidity and intensity of our fire, the explosion of the enemy's magazine exercised a decisive influence on the defence of the place. If, therefore, susceptible of practical application to the operations of the field, it is in ratio to its projectile power that the value of Captain Warner's invention must be estimated. Based on the knowledge which chemical analysis has obtained of the extreme susceptibility of various explosive powers, it is a possession of the practical application of the invention in question which has by scientific men been pronounced impossible. However, many of the most valuable discoveries of modern chemistry owe their origin to the much despised labours of alchymists. It does not, therefore, surpass the bounds of probability, that Captain Warner may have discovered some explosive power equal to if not surpassing in its terrific results every other we are in possession of, and which may be handled with the same impunity as every other composition used in military projectiles.

Chemical science is far from having attained its final limit. Every invention should, therefore, have fair play, and not be disparaged on account of its supposed absurdity or apparent inutility.

If, therefore, Captain Warner can practically illustrate what he has asserted, at one fell swoop, he will become the first artillery officer of the age. The application of his extraordinary power would at once suppress the whole "attirail" of modern artillery. As Jomini observes, "il feroit concevoir combien une armée agit avec plus de vélocité et d'impetuosité lorsqu'elle n'a d'autre calcul à faire que celui de la vigueur des jambes de ses soldats." It would, in fact, realize this fundamental principle, that the concentration of one great decisive effort is preferable to a succession of partial and disseminated ones, even if in the aggregate the sum of the latter should be greater. But what, more than any other cause, has disposed practical men to treat the pretensions of Captain Warner as absolutely chimerical, is the startling assertion of his faculty to attain a range of six miles. Yet it may be questioned if even this surpasses the bounds of probability. Now what is the path which heavy bodies describe in the air that have received from an exterior force an instantaneous and determinate direction? This is the mechanical question, the solution of which constitutes the principle base of the practical art of the flight of projectiles.

The whole theory of the motion of projectiles *in vacuo* is contained in a few propositions, but the resistance of the air occasions so prodigious a diminution of motion in the great velocities of military projectiles, that the parabolic theory based on the supposition of the flight of shots though a non-resisting medium, is of no use. It is only in very slow motions, not exceeding 300 to 400 feet in a second, that this theory is of any avail, for at that rate the path of the projectile differs little from the parabola. Thus a 24-pound shot, fired with a charge of 16 pounds of powder, at an angle of 45°, should, according to this theory, range about 16 miles, but its actual horizontal range is short of three.

The variety and irregularity of all the experiments that have been made on the resistance of the air to the flight of projectiles, proves that our knowledge of its law and measure is extremely uncertain and imperfect. But the experiments of Robins and Euler have proved thus much, that the resistance to a motion exceeding 1100 feet in a second is three times greater than in the duplicate ratio of the resistance to moderate velocities; that to a velocity which is double another, the resistance is fourfold; to a treble velocity ninefold, and so on. Hence it follows, that when the ball moves swifter than at the rate of 1200 feet in a second, that whatever be the regular range of a shot discharged with that velocity, that the range will be but little increased, however the velocity of the ball may be augmented by a greater charge of gunpowder[a].

To project a ball, therefore, a distance of six miles by means of any explosive force, the action of which on the projectile is instantaneous, and ceases from the moment that it leaves the mouth of the piece, *is physically impossible!* But, while maintaining this position, we are not prepared to deny the possibility of obtaining that result by means of a projectile that *shall contain within itself the principle of movement*. This principle is peculiar to the rocket. And, although from this inherent cause, hitherto no certain result has been obtained from these projectiles beyond a limited range, still as the principle is known, the question to be solved is, the possibility of its elaboration. Whether, for example, the combined skill of the mechanist and the pyrotechnist can so graduate this self-moving principle, so as to impart to the projectile a velocity that will not expose it to the law of atmospheric resistance,

[a] Independent of the resistance arising from the inertia of the air, when it is put in motion by a shot, there is also a resistance from the condensation of the air on the anterior surface of the ball and a rarefaction behind it, besides a third resistance from the statical pressure of the air on its anterior surface when the velocity is great. The air's resistance not only diminishes the celerity and opposes the motion of projectiles, but it causes them to deviate from their regular path, from which last cause arises the great deviations observed in artillery practice.

and at the same time a sufficient intensity of action to accomplish its trajectory course. *If Capt. Warner can really attain a range of six miles, it is by this principle alone.* But, even if this range can be obtained, we may question the power of directing a projectile through so long a trajectory with any degree of accuracy. Against so wide a space as that occupied by a town, a flight of these rockets might be directed with some probability of a result. But, ignorant as we are of every detail connected with this invention, it is bootless to indulge in speculation beyond the range of the known causes that govern the flight of projectiles.

Before concluding this paper, there is one question connected with Capt. Warner's invention that we may be permitted to examine; and that is, even could he realize all he asserts, what would be *its value?* This, we are prepared to maintain, is comparatively little, unless the Government that acquired the possession of the secret should be prepared to seize the *initiative*, and, availing itself of the extraordinary powers placed at its disposition, to rush like Attila or Ghengis Khan into one wild career of universal conquest. For, as Dugald Stewart has so profoundly observed, "the invention of printing was not so much the effect of a fortunate accident, as the result of those causes on which the progress of society seems to depend; for, although the invention of printing was accidental, with regard to the person who made it, it may be considered as the natural result of a state of the world, when a number of great and contiguous nations are all engaged in the study of literature, in the pursuits of science, and the practice of the arts; and, therefore, if this invention had not been made when it was, the same, or some analogous art, would have been invented at no distant period."

Reasoning, therefore, by analogy, we may venture to infer, without for a moment wishing to disparage the merit of Capt. Warner, that, in the present state of physical science in Europe, no discovery or invention can long remain a secret; a consideration, whatever may be the intrinsic, that must materially detract from the relative value of Capt. Warner's invention—and a consideration that appears to have exercised, in all their negotiations on the subject, some influence on the conduct of Her Majesty's Government.

THE PRODUCTION OF EARTHQUAKES BY THE ELECTRIC FLUID.

By John Joseph Lake.

The phenomena attending the Calabrian earthquakes of 1783, afford the strongest evidence of the production of these cata-

strophes by electricity, and in that respect they are not inferior to the cases that have been already noticed[a].

At a quarter before one, P.M., on the 5th of February, 1783, a rumbling subterranean noise, like a succession of thunders, was succeeded by a dreadful earthquake. At first the soil began to shake gently, but the vibration soon became violent, some of the shocks being strong and irregular; they then decreased nearly in the same manner they had commenced, the whole lasting about two minutes. The first impulse of the earthquake, according to the testimony of the inhabitants of the plain, was vertical from under the surface upwards.

There are here the most distinct proofs of the passage or subterranean discharge of a quantity of electric fluid, through a series of conductors of different powers, affording different degrees of facility to its progress, in the loud reports, "like a succession of thunders," the expansive force of the fluid causing the upward movement of the ground, and the repetition of the shocks. As it approached the spot where the observer stood, the soil began to shake gently, but the repetition of the discharges, with the diminution of their distance, increased the vibration. When the opposing medium was weak, the discharge was more rapid and less violent than when it was strong; for in the latter case a greater body of fluid was required to overcome the impediment, and a detention in its progress took place until the necessary quantity collected[b]. In the present instance, the shocks gradually passed away, and the phenomena in every respect resembled those of a passing thunder-storm, like the earthquakes of 1755[c].

Before this earthquake took place, the fishermen on the shores of Bovino and Pizzo were obliged to relinquish their occupation and land; for though there was no wind, yet the sea at some distance appeared to be in an extraordinary state of ferment and ebullition. On the eastern coast, near Cape Ruzzuto, it was unusually agitated, and overflowed the shores, and some assert that at that time they felt a slight tremor of the

[a] Polytechnic Review, May, 1844, p. 263; June, 1844, p. 18.

[b] This is an explanation of an objection and difficulty raised by the writer of the article *Earthquake*, in "Rees's Cyclopædia," where, concerning the electric theory of the origin of these catastrophes, he says:—"Several others cannot be reconciled to it; for instance, in the earthquakes in Calabria, in 1783, small shocks, strong shocks, and extraordinary commotions followed one another at short intervals, without any order or regularity. Now it is difficult to comprehend how the electric fluid, which produced these shocks, could find an exit, why a large quantity of it (which can more easily cut its way through any obstacle) could not come out at the same time, and yet not long after, this large quantity comes out of its confinement and produces a great earthquake." This objection might have been made to lightning being electricity, for the discharges of the fluid in a thunder-storm vary much in quantity and time of succession.

[c] Polytechnic Review, June, 1844, p. 18.

earth. But however this may be, it appears that the sea was first affected, and by a phenomenon peculiar to that climate, called by the Italians *mare-moto* or *seaquake*[*].

In addition to the agitation the sea experienced before the shock, it retired from the shore when the shock occurred, but flowed again, and repeated this three times, affording an incontrovertible proof of the elevation of the land by some subterranean force.

The second earthquake, which happened at midnight, between the sixth and seventh of the same month, February, was attended by a dreadful rumbling noise. It lasted one minute and a half, and ended with the same uniform violence, affording similar evidence of an electric discharge, much severer than the first. The movement was so violent that it detached the greater part of a mountain, called Monasina, much higher than that of Scilla, which was overthrown the previous day, and precipitated into the sea. Vivenzio also relates that it overthrew another, which he calculated to measure a square mile and a half, also into the sea. About half a minute after this fall, two waves, accompanied by a horrid roaring, proceeded towards the shore to the altitude of thirty feet. During the catastrophe, the sea retired and returned again three times in about two minutes.

Whether we might refer the rising of the two waves to the phenomenon of seaquake, (for it being midnight it could not be seen whether there was any disturbance of the sea, as on the preceding day,) or to the shocks first affecting the sea, there is not sufficient evidence to determine; but the retiring and returning of the water three times in the short space of two minutes, can only be referred to the upheaving of the earth.

The third great earthquake took place on the afternoon of the following day, the 7th. It lasted about two minutes and a half, and was attended with a rumbling noise, which commenced simultaneously with the commotion. The shocks were of various kinds; horizontal, vertical, whirling and waving.

The fourth happened very early on the morning of the 1st of March following. This was also accompanied with great subterranean noise. It lasted about one minute and five seconds, and was tremendously violent throughout its whole duration. The shocks were at first undulating, but, after a short intermission, changed into a sort of whirling motion.

The fifth and last great earthquake happened on the 28th of March, in the same year, about an hour and a quarter after sunset, and lasted about two minutes. The shocks were of various kinds, the last of which was most violent.

There is one feature of these catastrophes that affords strong evidence that the electric fluid was the cause of them; it is that

[*] For some notice of this singular phenomenon, see United Service Journal, July, 1829, p. 29.

the moving power acted both horizontally and vertically. Though both motions were felt simultaneously, yet the vertical movement was particularly experienced in the first and second earthquakes; the horizontal direction of the moving agent is most plain in the third; and it seemed to act upon the soil as though it was water sending eddies in every direction. Similar effects were observed during the subsequent earthquakes, which continued during that and the two following years. But these could not have been produced by the agents to which earthquakes are usually attributed; namely, steam, confined or condensed air, explosions of gases, volcanoes and falling in of caverns; for the action of the first would, as far as the surface of the soil is concerned, be entirely vertical, and the last would only cause a *sinking*, and could not, under any circumstances, produce an upheaving to the extent experienced in Calabria. A discharge of electric fluid would, however, produce these effects, and combine all these motions; the horizontal in the line of its direction, the whirling on the margin of the parts moved horizontally, and the vertical by its expansive force.

Another feature of these earthquakes is the presence of the smell peculiar to great electric discharges, as when lightning strikes any object, as a building, &c. It is recorded that the inhabitants of Monteleone saw a dense fog rise from the sea, and those who happened to be involved in it perceived a disagreeable strong smell, as if it came from the burning rubbish of the buildings that were destroyed. Water also that was seen to spring out of the ground, as well as that of rivers, mostly emitted a sulphurous or phosphoric smell. This part of the subject is illustrated by the following note on Ozone, by Mr. C. V. Walker, accompanying a paper read to the Electrical Society, "On the effects of a lightning flash on the steeple of Brixton Church,"[a] and by which it appears that such a smell is produced by great electric discharges. He says, "Professor Schönbein, in his paper on Ozone, regrets that we have not been able to gather a sufficient number of observations, and especially of those of philosophers, upon the nature of the odour developed by a stroke of lightning. The term sulphurous or phosphoric, which is commonly applied to it by those who chance to have been present, originates, in his opinion, in vulgar prejudice, which gives those familiar names to every pungent odour. 'If,' says he, 'the gaseous body disengaged by the lightning penetrates the nose of the observer in a concentrated state, he will imagine he perceives an odour of sulphur; if, on the contrary, it is presented diluted with much air, he will imagine he perceives an odour of phosphorus.' It is the Professor's opinion, that the odour is really that exhibited in the vicinity of electrical machines when in good action; and

[a] Proceedings of the Electrical Society, 1841-42, p. 309.

that the odorous principle is a gaseous body developed by electric action, to which he has given the name of *ozone*. Prepossessed, rather than otherwise, in favour of the *electrical character* of this odour, I made very careful inquiries; and when the attendants of the church told me that the flash was attended by a very strong smell of sulphur, I began to think with Schönbein, that the odour of ozone, being more akin to this than any other they knew, was at once described as sulphurous, but on inquiring of gentlemen who were present, and who were well acquainted with the electrical odour, I find that it was '*decidedly sulphurous*, and not like that which follows common electricity. A portion of stone which was grooved out by the lightning, retained a strong sulphurous smell, even until the time of evening service. . . . . The smell at the bottom of the tower, within the porch, where the lightning descended, was precisely the same, though in a less degree."

As in other earthquakes the presence of electric fluid to an unusual extent, or in an uncommon manner, was denoted by the state of the atmosphere, so also in 1783. During the first two days of February, the sky was either clear, though not perfectly so, or covered with broken clouds, and the sun appeared somewhat inflamed. The morning of the 5th commenced with nearly the same appearances, but a haziness came gradually on. One very curious circumstance was, that previous to most of the shocks, when any clouds were dispersed in the atmosphere, they generally collected together and remained stationary, suspended as it were over some particular spot. But it was not in Calabria alone that the atmosphere manifested unusual phenomena; for they appeared throughout all Europe and part of Asia, and are thus recorded by an eye witness:—"The summer of the year 1783 was an amazing and portentous one, and full of horrible phenomena; for besides the alarming meteors and tremendous thunder-storms that affrighted the different counties of this kingdom, the peculiar haze or fog that prevailed over this island and every part of Europe, and even beyond its limits, was a most extraordinary thing, unlike any thing in the memory of man. By my journal, I find that I had noticed this strange occurrence from June 23 to July 20[a] inclusive, during which period the wind varied to every quarter without making any alteration in the air. The sun at noon looked as blank as a clouded moon, and shed a rust-colored ferruginous light on the ground and floors of rooms, but was particularly lurid and blood-coloured at rising and setting. All the time the heat was so intense that butchers' meat could hardly be eaten the day after it was killed, and the flies swarmed so in the lanes and hedges, that they rendered the horses half frantic, and riding

[a] Calabria was disturbed by earthquakes during the whole period from 1783 to 1786 inclusive.

irksome. The country people began to look with superstitious awe at the red lowering aspect of the sun; and, indeed, there was reason for the most enlightened persons to be apprehensive; for all the while Calabria and part of Sicily were torn and convulsed with earthquakes, and about that juncture a volcano sprung out of the sea at the coast of Norway."[a]

Here, again, are a series of attendant phenomena that could not have been produced by the explosion of gases, steam, volcanoes, or any other agent with which we are acquainted than electricity. Volcanic disturbance might have caused the sun to be inflamed by loading the air with gases and other volatile matter, but neither it nor any other agent but electric fluid could have caused the clouds to collect together and remain stationary over a particular spot previous to a shock. Neither could they have produced the mist that prevailed so generally in Europe, but it is highly probable that the electric fluid gathered it together as it did the clouds in Calabria. That this was the agency, is all but confirmed by the thunder-storms experienced in England; or, at least, it is quite certain they could not have been produced by the other agents above mentioned; and they shew the disturbed state of the electric fluid.

With respect to volcanic agency, it is true that a volcano sprung out of the sea off Norway; this, however, might have arisen from combustible materials becoming ignited by electric action. But if it arose legitimately from volcanic action, it was local and of small extent, and did not affect the Italian and Sicilian volcanoes, for it is singular that they were not in a state of eruption during these calamities, but appeared disturbed by the shocks themselves.

The same intelligent observer has also recorded other remarkable electric phenomena, during the continuance of these calamities, which prove the peculiar and unusual electric state of the earth during the time of these earthquakes. "On June 5th, 1784, the thermometer being at 64°, and at noon 70°, the barometer at $29\frac{6}{10}\frac{1}{2}$, and the wind N., I observed *a blue mist*, smelling strongly of sulphur, hanging along our sloping woods, and seeming to indicate that thunder was at hand. I was called in about two in the afternoon, and so missed seeing the gathering of the clouds in the north, which they who were abroad assured me had something uncommon in their appearance." After describing the direction and violence of the storm, he adds, "Though the clouds at South Lambeth, near London, were at that juncture thin and light, and no storm was in sight, nor within hearing, yet the air was strongly electric, for the bells of an electric machine at that place rang repeatedly, and fierce sparks were discharged."[b]

[a] Natural History of Selborne, by the Rev. Gilbert White, Part II. Letter LXV.

[b] Ibid. Letter LXVI. It is a pity there are not more facts of this kind on record.

But there is yet plainer and more convincing evidence that the earthquakes of Calabria in 1783 were caused by electric, and not volcanic, or any other agency.

At Casal Nuova an explosion occurred, for it was not a mere shock, which destroyed that place, with the Princess Gerace Grimaldi and 4,000 of her subjects. An inhabitant, who was at the moment on a hill overlooking the plain, feeling the shock, turned round. Instead of the town, he saw only a thick cloud of white dust, like smoke, which was thought to arise from the crushing of the buildings. Had this arisen from the combustion of gases, volcanic action, or steam, the explosion, judging by the description given of it, and its effects, appears to have been so near the surface, that some means of tracing them would have been found. But, excepting volcanic action, these must be put aside, it being already shewn that they could not have produced other phenomena. But it is to be observed, with respect to volcanic agency, that it is very remarkable that Etna, the nearest volcano, should have been very little disturbed [a], and more especially as it developed itself, in Calabria, in violent explosions at or near the surface of the soil. Catania was levelled to the ground by a similar explosion during the Sicilian earthquakes of 1693, and, as at Casal Nuova in 1783, nothing but dust appeared, though, from Catania being much nearer to Etna, there might be a stronger probability of the volcanic nature of the disturbing agent. It is quite evident, however, that the explosion in 1693 was not volcanic, for Etna itself appeared to be disturbed by the earthquake, emitting vast volumes of flame. But if the catastrophe had resulted from volcanic disturbance, that mountain must have sent forth something beside flame, and been in a state of violent eruption, to produce such an earthquake as then desolated Sicily. Having thus a parellel case in which the appearances are more decided, the probability that the explosion that overthrew Casal Nuova was electric is greatly strengthened, and that it was volcanic, is quite overthrown. Etna was similarly disturbed during the Calabrian earthquakes in 1638 [b].

The probability of electricity being the cause of these convulsions, is still further sustained by observing the locality of the earthquakes. Their greatest force was exerted at Oppido, and the shocks were felt from Cape Ruzzuto to Palermo. If the disturbance had been volcanic, the neighbourhood of Etna and Stromboli would have been the centre of the convulsion, as on the bursting forth of Vesuvius in 1779, and of a volcano at Arquepa, in Peru, in 1600, and every other instance of the kind.

[a] "Mount Ætna in Sicily, and the volcano of Stromboli, had smoked less than usual before the earthquakes; but they both exhibited [only] appearances of an eruption during the earthquakes."—Rees's Cyclopedia. Article *Earthquake.*

[b] Polytechnic Review, May, 1844, p. 263.

But in the present case, the centre of the convulsion was far removed from these volcanoes, and they appeared to be themselves disturbed by it.

The direction in which the force seems to have been exerted is also strongly confirmative of the position that the earthquakes were not of volcanic origin, for the vibration of the soil was in the direction N.N.E. to S.S.W. Now if the force had come from Etna, Stromboli, and the other volcanoes, the direction of the movement would have been across this line; but its course was quite away from these mountains, along the Calabrian hills[a].

But the strongest evidence, and it would seem to be sufficient to set the question at rest, whether electricity does or does not produce earthquake, was obtained by actual experiment. During these convulsions in Calabria, Dr. Nicola Zupo, a physician at Cosenza, conceiving such to be the case, stuck an iron rod, twelve feet in length, into the ground, leaving a pointed extremity above the surface. He observed electric fire proceed from the point at the time of many of the shocks, and thus obtained a proof that it was the cause of the catastrophes, as plain as that of Dr. Franklin as to the identity of the fluid and lightning. It is also worthy of remark, that during the earthquake at Manchester, in 1777, noises were heard in the neighbourhood of conductors of electricity[b].

Mr. Henry relates that on the morning of this earthquake (September 14th) he was confined to his bed beyond the usual hour by a headache, with which he was greatly troubled previous to any storm or considerable change in the atmosphere, and with which many persons suffer before a thunder-storm, or on any occasion when the electric fluid is in an uncommon condition. About five minutes before eleven, A.M., he was alarmed by a noise which he thought resulted from a bale of goods falling below stairs. On the second shock occurring, he heard such a rattling in the north-east corner of the house that he thought a portion of it had fallen. A third and more violent crash followed, resembling the falling of a large and lofty wall. Each noise was succeeded by a separate concussion, and the time occupied by the whole was at least half a minute. At the instant of the second explosion, Mrs. Henry received a very smart stroke on the top of her head, which made her think that something had fallen from a shelf upon her. A pain, attended with a degree of stupor, remained in the part of her head that had been affected for several hours.

[a] This fact is an evidence of the direction of the electric currents along the lines and elevated parts formed by mountains and high lands. See Polytechnic Review, June 1844, p. 22. The motion of a rushing that attended the earthquake of 1777, which we shall notice immediately, was from south-west to north-east.

[b] Phil. Trans. 1778, p. 221.

Several other persons likewise received strokes, like electric shocks, in different parts of their bodies. At Blackley, a small village about three miles from Manchester, a servant stooping at some little distance from a chest of drawers, which stood up to the wall, received so severe a blow as to strike her to the ground. Similar things have occurred at the time of thunder-storms; and one case came under my own observation in London, where, during a thunder-storm, the lightning descended into the street, and ran along the ground, throwing down an old woman, without however hurting her. A person who was stooping in a parlour past which the fluid went, felt a shock as though her head had been forced down by a person's hand, which was succeeded by a degree of stupor for the remainder of the day. Many people complained for several days after this earthquake of nervous pains and hysteric affections, and also of sensations "similar to those of persons who have been strongly electrified."

Mr. Henry also relates that the noise was particularly loud in houses furnished with conductors, and, as far as he was able to collect, was loudest in those parts of the house where the conductors were fixed.

The facts of this case at Manchester require no comment to show that the electric fluid was the cause of the shocks, and that they could not arise from any of the other agents, but especially from any of the other agents above mentioned.

The great obstacle to the general reception of the electric theory concerning earthquakes, is our ignorance of the nature of the electric fluid, and how it can accumulate in sufficient quantities to produce them. But it is surely not the custom in science to reject a part because, with our present means and information, we cannot make out the whole. The time may be near when we shall be better acquainted with this mysterious agent, for our knowledge of it has increased of late years with rapid strides. But in the mean time let us not reject that part of which there is sufficient proof; and, amongst other things, let us receive this,—that the electric fluid does produce earthquake; for, however, inefficiently set forth, the facts contained in this paper incontestibly prove that such is very frequently the case.

THE THERMÆ OF THE PYRENEES.

"Laudabunt alii claram Rhodon, aut Mitylenem,
Aut Ephesum, bimarisve Corinthi
Mænia." HORATII—*Ad Munatium Plancum.*

If another Zimmermann were to arise, he could select no fitter field for the composition of a work on solitude than the British metropolis at the present season. The long avenue at Pal-

myra—the ruins of Baalbeck—the temples and amphitheatres of Djerash, are not more desolate than its most fashionable quarters. If a sound breaks on the solemn silence of the scene, it is the rolling wheels of a travelling carriage, hurrying off some of its fashionable and aristocratic denizens to the extremities of Europe. Not a spot escapes the eager curiosity of our tourists. In spite of Schamil Bey and Russian espionage, detachments are even seen moving from Kastantinogorsk, on the line of the Kuban, by the right bank of the Podkuma, on the celebrated Caucasian springs at the foot of Mount Elbrouz. And all this for the mere pleasure of saying, "We have been there." With truth, a celebrated philosopher has observed, that things are nothing in themselves, but in the ideas we associate with them.

With the whole continent before him, the tourist, if embarrassed for a field of operation, need only consult Murray. But if limited for time—if desirous of visiting scenes unrivalled for beauty of scenery, for salubrity of climate, for diversity of race, for the luxuriant and various productions of nature so dear to the gastronome, and for historical and poetical associations—let him make the tour of the Pyrenees. If less grandiose than the Alps, their more southern clime imparts to them a sunny softness, an exuberance of vegetation, which Switzerland does not possess, and a peculiar beauty unsurpassed by any mountain scenery on the face of the globe.

For the tour of the Lower Pyrenees, the traveller should make Tarbes his base of operation. If fond of horseflesh, after visiting its magnificent Haras, leaving his heavy baggage behind him, he may commence his march on the mountains by an advance on Bagnères de Bigorre, pompously styled by its inhabitants, "the Paris of the Pyrenees."

BAGNERES DE BIGORRE.

At Bagnères de Bigorre there are between thirty and thirty-five sources; their temperature varies from 13° to 40° of Reaumur. Eight of the most reputed sources supply the great bathing establishments. They are, La Reine, Le Foulon, Le Dauphin, Le Roc de Lannes, Les Yeux, Le St. Roche, &c. There are many other thermal sources at Bagnères which belong to individuals; the most celebrated are those of Le Salut and Labassere; in addition to which there are two ferruginous sources and one sulphureous source (cold). The temperature of nearly all these sources is very elevated. "Originally of the same nature as the sulphureous sources of the Pyrenees," says a celebrated chemist, "they have without doubt undergone in the bosom of the earth, in the heart of the mountains, alterations which apparently have converted their sulphur and sodium into a sulphate, and their caustic alkali into a carbonate. The waters of Bagnères are specific in cases of obstructions of the bowels and

liver, in chronic inflammations and hæmorrhoids, in cutaneous disorders, and in old wounds. In the complaints of females and obstinate constipations, they are considered sovereign remedies. The thermal establishments of the Pyrenees are all under the direction of an inspector-general, appointed by the government.

Bagnères is the most fashionable place in the Pyrenees; the season lasts from August to October, but it is also an agreeable winter residence. The town is remarkably pretty and clean, the Adour running through most of its streets. It contains a theatre, a cassino, and three excellent hotels. Six to seven francs per diem, including bed, is their usual charge; a rate, in fact, common to all the hotels of the Pyrenees. The character of the scenery at Bagnères is a mezzo terminé between the savage grandeur of the upper regions of the mountains, and the sunny beauties of the plains which it overlooks. For picturesque beauty, the valley of Campan is justly celebrated. From this valley, a mountain path will conduct the traveller over the Tourmalet to Barèges, should he prefer that route to the more circuitous post road by Lourdes.

BAREGES.

There are six sources at Barèges, varying in name, temperature, and properties.

1st. La Chapelle; its temperature is from 24° to 25° Reaumur; its superabundant waters are conveyed into the baths supplied from the hotter sources.

2. The New Bath . . . . . temperature	29°
3. L'Entrée	31
4. Bain du Fond	28
5. Bain Polard	30
6. La Temperée	27

These six sources are distributed among fifteen Cabinets de Bain, which, on account of the diversity of their waters, have each their peculiar results. There are, in addition, two shower baths; their temperature varies from 34° to 36° of Reaumur.

Although but slightly sulphureous to the taste, the waters of Barèges are to the smell highly impregnated with the odour of sulphur. All the sources throw off bubbles which contain pure azote. The component parts of these waters are, the sulphur of sodium, sulphate of soda, and silex. From their exciting qualities, they act so strongly on the nervous system as to produce fever, and hence is attributed their excellent effect in numerous chronic diseases. They promote circulation, and stimulate the different organs; are efficacious in chronic rheumatism, sciatica, sprains, white-swellings, lameness, cutaneous disorders, fistula, old ulcers, and paralysis. They are especially specific in gun-shot wounds. A military hospital

for the invalids of the French army was established at Barèges so far back as the reign of Louis XIVth.

Like all sovereign remedies, the waters of Barèges must be taken with great precaution; in some cases they effect the most miraculous cures, and in others have proved fatal, when taken *mal-à-propos*.

In the Roman world, the Thermæ of Barèges enjoyed a high reputation. Sertorius and Cæsar embellished them in a style worthy the grandeur of the empress of the world. In more modern times, they were frequented by Marguerite de Navarre, the sister of Francis I., the fair and accomplished authoress of the Heptameron, by Henry IV., and lastly, by Madame de Maintenon and her youthful charge the Duke de Maine. From its great elevation, the season at Barèges is short; during the winter months it is totally abandoned. From Barèges the traveller descends by the valley of the Bastan to Luz, at a short distance from which, at the mouth of the gorge leading to the celebrated Cirque de Gavernie, are situated the Baths of St. Sauveur.

ST. SAUVEUR.

St. Sauveur possesses but one source. At the shower bath, the temperature is 18° Reaumur; at Bezegna, 27°; at La Terrasse, 26°; at La Chapelle, 24°. These waters are particularly recommended in nervous affections, coughs, and in disorders of females; they are administered internally, in baths, and *à la douche*. Half a league from St. Sauveur are the waters of Visos, which are of a recent discovery, and are considered more efficacious than even those of Barèges; but the volume of the waters is so small, that it has not been possible to construct a bathing establishment. They are administered *en bassin*, injections, and fomentations.

The Cirque de Gavernie, at the mouth of which these baths are situated, is justly celebrated for its surpassing loveliness and sublime grandeur. The Giant Marboré, and the Breche de Roland, through the aperture of which, as through a casement, the traveller beholds at his feet the plains of Aragon, and on a clear day the distant cities of Huesca and Saragossa, was pronounced by Chateaubriand to be superior to any scenery in the Alps. From this point the tourist must retrace his steps by the same route to Pierrefitte, whence by a magnificent gorge he descends to

CAUTARETS.

There are eleven sources at Cautarets, similar in composition to the other sulphureous waters of the Pyrenees. To the east of the town are the baths of Bruzaud, Rieumiset, and the Spanish. At some distance, on the declivity of the mountain, the two sources of Pausias and Cæsar, and beyond them the

source of La Railliere, the most efficacious of all. The bathing establishment at La Railliere is a handsome edifice, containing two superb salons, and twenty-three cabinets de bains, all of marble à la Romaine. On the opposite bank of the torrents are the sources of Du. Pré, Petit St. Sauveur, Des Œufs, Du Mahourat, and Du Bois. The temperature of the different sources varies from 26 to 40 degrees of Reaumur. They are sweeter but not so strong as the waters of Barèges. In scrofulous and chronic gastric diseases they are highly efficacious, and especially in colds of long standing which threaten consumption. Every year, at the same season, horses touched in the wind are sent from the Haras at Tarbes. Morning and evening they are led out to drink at La Railliere, are then gently exercised, and at the end of thirty days generally return perfectly cured. The patient generally commences with the waters of La Railliere, which are succeeded by those of Pausias.

Next to Bagnères, Cautarets is the most fashionable place in the Pyrenees; the hotels are good, and private lodgings abundant. There is also a cassino, at which, during the season, balls and concerts are given. To the lover of the picturesque and the sportsman the environs of Cautarets present a wide and extended field of gratification. The excursion to the Pont d'Espagne and Lake de Gaube presents scenery of unrivalled beauty, and affords ample food both for the gun and the pencil.

Leaving Cautarets, the tourist descends by the Valley of Argallez to Lourdes. Here he leaves behind him the sublime grandeur of the Pyrenees, and plunges into the sunny plains of Bearne, passing, by the right bank of the Gave, through a richly cultivated, picturesque, and highly populous district to Pau, the ancient capital of Bearne. If the traveller approaches Pau from the north, he will, for the first time, appreciate the truth of the term which French vanity applies to the whole of France, viz., La belle. From the terrace of La Place Royale the view embraces the lovely valley of Gave, with the line of the Pyrenees as a back ground; a view for unsurpassing beauty and sublimity that may be justly compared to Berne, Satzbourg, and Grenada. For the mild salubrity of its climate, for the beauty of its environs, for its luxury and cheapness of living, and for the charms of its society, Pau, as a winter residence, is unsurpassed by any town in France. In its lovely promenades may be seen, in beautiful juxta-position, the graceful Parisian, the stately blue-eyed daughters of the British Isles, and the bewitching Señoritas of romantic Spain, their graceful mantillas beautifully contrasting with the scarlet and white capuces of the Bearnese, or the more gracefulcoiffures of the long-haired Basques, which, combined with the wild and graceful costume of the Aragonese contrabandista, and the gay uniforms of the officers of the garrison, impart to the whole scene a picturesque beauty rarely, if

ever, seen in the North of Europe. Of late years, Pau has become at once an English and Spanish colony; combining all the comforts of England with the luxuries of the South. As a winter residence for pulmonary patients, it is justly celebrated, and it enjoys the advantage of an English resident physician, Dr. Taylor, who, for high professional skill, urbanity of manner, profound and versatile acquirements, has justly endeared himself to all who may have made Pau their head quarters for the winter. His recent work on the mineral waters of the Pyrenees should be read by all patients proceeding to these Thermæ in the pursuit of health.

Among other advantages, Pau possesses an admirable seminary for female education, established by Madame Godin, and now conducted by Madlle. Bearnais.

At five leagues to the southward are the baths of the Eaux Chaudes and Eaux Bonnes. The Valley d'Ossan, by which these baths are approached, is one of the most beautiful in the Pyrenees: in fact, from their propinquity to Pau, and the romantic beauty of the scenery, the Eaux Bonnes is fast becoming the most fashionable place in the Pyrenees, and is the annual resort of the élite of Parisian society. The bathing establishment, the hotels, and lodging-houses are all in the first style. The efficacy of these waters was first discovered in the reign of Francis I., by their salutary effects on the wounded arquebusiers whom Henri d'Albret led to the disastrous battle of Pavia. Hence their name, Eaux d'Arquebusades. The traveller should not fail to ascend the Pic de Midi, or to visit the Baths de Penticousa on the Spanish side of the mountain.

LES EAUX BONNES.

There are four sources at Les Eaux Bonnes. 1. La Vielle Source, or Buvette, temp. 25° Reaum. 2. La Source Neuve, 24°. 3. La Source Ortechq—on the declivity of the mountain—less warm than the two others; and 4. another source on the flank of the mountain, higher up than La Buvette: its temperature is 11°.

These waters are clear, sweet, oily, and charged with some *flocons de Baregène;* their odour is slightly sulphureous. Their composition cannot be attributed to the minerals of the Pyrenees, which at this spot are calcareous. La Buvette, however, deposits a mixture of silica and carbonate of chalk, which, without doubt, comes from the mountain.

The Eaux Bonnes, in numerous cases, are considered the most salutary in the Pyrenees; they dissolve by enchantment *les durêtés cellulaires*, cleanse the surface of wounds, and are recommended in all chronic diseases; but their greatest triumph is in pulmonary complaints. These waters are used by such patients as are too delicate, or of too irritable a temperament to try the other baths of the Pyrenees.

LES EAUX CHAUDES.

These baths are situated about about three miles from Les Eaux Bonnes. There are six sources:

1. Le Roi	. . . .	temp. 26°
2. L'Airessecq	. . . . .	20
3. La Redot	. . . . .	22
4. L'Esquerette	. . . . .	27
5. Le Trou	. . . . . .	28
6. Mainvelle (cold)	. . . . .	9

In paralysis and rheumatism, these waters are highly celebrated; they are also recommended in complaints of the liver and spleen, jaundice, &c. The water of L'Esquerette, taken in strong doses, produces intoxication.

There are several other mineral waters in the Central and Eastern Pyrenees; among the most celebrated of which are those of Bagnères de Luchon, which were well known and esteemed by the Romans.

PROJECTILE WEAPONS OF WAR AND EXPLOSIVE COMPOUNDS.

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(Continued from p. 174.)

Although we know the cross bow to have been used in the reign of Edward II., yet it would appear that about this time the use of the long bow became extended: at least we now begin to find the word *sagittarius*, (an archer,) whereas he who shot with a cross bow was termed *ballistrarius*. Not only were long bows employed as well as cross bows against the Scots, in 1323, but also in the next year, by the army sent to the relief of Aquitain. It would seem that the arbalest and the long bow had only to be used together, in order to prove the vast superiority of the latter, for its extension now rapidly increased, and in the reign of Edward III. the glory of this weapon was in its zenith. This monarch appears to have taken great pains to increase its efficiency and extend its use. In 1342, the sheriffs of most counties in England were ordered to provide 500 white bows, and as many bundles of arrows, for the intended war against France. Subsequently to this, the king again sent to the sheriffs, complaining that the practice of archery was too much neglected by the people, who, instead of shooting on Sundays and holidays as heretofore, were in the habit of amusing themselves with various unlawful games. The terrible execution effected by the English archers, at the battle of Crecy, in 1346, is well known, and in this instance the peculiar genius

of the weapon, and its superiority over the arbalest, were well displayed. Previously to the battle, there fell a shower of rain, which so slackened the strings of the cross bows used by a troop of Genoëse in the French pay, that the weapons became almost unserviceable, whereas the English long bows, which had been encased during the shower, were perfectly effective. It is obvious that the very shape of the cross bow would prevent its being surrounded by a case, and here, as in many other instances, the long bow had a decided advantage.

Ten years after this occurred the battle of Poictiers, which was also won by the skill of our archers. The decisive victory of Homeldon against the Scots, in 1402, was entirely achieved by them; and the Earl of Douglas found that the English arrows were so swift, and so strong, and discharged so forcibly, that no armour could repel them: his was of the most perfect temper, and yet he was wounded in five places. The English men at arms, knights, and squires never drew sword or couched the lance, the whole affair being decided by the archers. The archers again did terrible execution at the battle of Shrewsbury, in 1403, where Hotspur was slain; and the battle of Agincourt, in 1417, was their undivided conquest. So many victories accomplished by the employment of our favourite weapon, would, it might be supposed, have induced the enemy to imitate us; nevertheless, this does not seem to have been the case; the French pertinaciously adhering to the employment of the arbalest; for which reason Henry V., as Duke of Normandy, confirmed the charters and privileges of the *Ballistrarii*, who had been long established as a society at Rouen. When we come to consider the long training, strength, and address necessary to constitute a successful archer, we need not wonder that the practice of the long bow was not more copied by our neighbours. How severe this training was may be gathered from certain statutes made long subsequently to the periods we have just spoken of; in the reign of Henry VIII., when portable fire-arms had been some time introduced, and when the practice of archery had in consequence somewhat declined. Henry VII., it should be premised, altogether prohibited the use of the cross bow[a], although he did not hesitate to use it himself for the purpose of shooting for wagers: this prohibition might have been effectual at the time, but it was not permanently so, as we may learn from the fact that Henry VIII., less than twenty years afterwards, renewed the prohibition. He forbade the use of cross bows and hand guns, and passed a statute which inflicted a fine of £10 for keeping a cross bow in the house[b]. Now followed a complaint from the bowyers, the fletchers, (or arrow makers,) the stringers, and the arrow-head makers, stating that many unlawful games were practised in the open

[a] Stat. 29 Hen. VII., A.D. 1508. [b] Stat. 25 Hen. VIII. cap. 17.

fields, to the detriment of public morals, and the great decay of archery. Those games were therefore strictly forbidden by Parliament; and then followed a third act, which obliged every man, being the king's subject, to exercise himself in shooting with the long bow, and also to keep a bow with arrows continually in his house. Fathers and guardians were also commanded to teach the male children the use of the long bow, and to have at all times bows provided for them, as soon as they arrived at the age of seven years. In connexion with this compulsory shooting at marks, we must notice the following remarkable proviso. "In case any person should be wounded or slain in these sports, with an arrow shot by one or other of the archers, he that shot the arrow was not to be sued or molested, if he had, immediately before the discharge of the weapon, cried out 'fast.'"[a] These statutes will show how necessary to the formation of an expert archer, constant exercise in the use of these weapons was regarded.

Hereafter, where we treat of fire-arms, it will be found that in the reign of Henry VIII. they had arrived at no inconsiderable perfection, yet the long bow was still the favourite weapon. Indeed, much later, in the reign of Elizabeth, the musket was so unwieldy and slow to charge and discharge, that the bow was considered superior by many[b]. By this time, the prohibition of Henry VIII. against the use of the cross bow, had been forgotten, or was disregarded, for we find that in the year 1572, Queen Elizabeth, in a treaty with Charles IX. of France, engaged to furnish him with 6000 men, part of them armed with long bows, and part with cross bows; and in the attack made by the English on the Isle of Ré, in 1627, it is said some cross bowmen were in the army, since which period they have been entirely laid aside, except for amusement[c]. The last time the legislature interfered for the protection of archery, was in 1633, when Charles I. issued a commission for preventing the fields near London being so inclosed "as to interrupt the necessary and profitable exercise of shooting." There have not been wanting, however, in later times, advocates for the occasional use of the long bow, in preference to the musket, and although the reasons adduced have some weight, they are greatly influenced by the prejudices of the writers. It is true that arrows can be shot from a long bow with far greater rapidity than balls from a musket, even with all the newest improvements: the flight of an arrow too is visible, but that of a ball is not; these two circumstances are in favour of archery. It has been maintained, also, that arrow wounds are more dan-

[a] Stow's Survey, by Strype, vol. i. p. 250.

[b] Toxophilus; or, the Schole of Shooting.

[c] The long bow, however, continued in use until a later period: in 1643, a company of archers was raised for the service of Charles I., and the Marquis of Montrose employed archers against the Scots.—Grose. Mil. Antiq.

gerous than those produced by balls, which to us appears, we must confess, a very doubtful proposition. It has been argued that, out of an equal number of arrows and balls, more of the former will hit the mark; a statement which is indeed probable, owing to the very unskilful manner in which the firing of musketry is usually conducted. An archer would be exposed to ridicule if he shot very wide of the mark; not so the musketeer, owing to the difficulty of discovering the fact. To this extent the advantages are on the side of archery; but let us now consider the disadvantages. In damp weather, the bow and bowstring were so much relaxed, that the efficacy of the instrument became very much impaired. A side wind deflected the arrow exceedingly in its flight, and against even a moderate wind it was difficult to shoot at all. In these respects the musket is as superior to the long bow as the cross bow is to the latter. We need not, however, endeavour to settle this point on theoretical grounds, there being on record the particulars of a battle, in which muskets were opposed to bows, and the result was decidedly in favour of the former. We allude to the battle of Lepanto, fought between the Venetians and the Turks, in 1571, a detailed account of which is given by *Paruta*, the Venetian historian, who states that one chief reason why so few Christians were killed in comparison with the Turks, was because the latter used for the most part bows and arrows, whereas the former were supplied with muskets. True, the archers in this case were not English but Turks; these people, however, used the bow exceedingly well, perhaps just as well as our own ancestors.

Having thus far traced the history of the bow, we purpose giving a short account on its range and powers. Unquestionably, the longest arrow shot concerning which we have any testimony, is that mentioned in Sir J. Malcolm's Sketches of Persia[a]. The story was originally told by Firdousi, the Homer of Persia, and has been repeated by many historians of good repute. In ancient times, (so goes the tale,) when *Mensocheher*, the grandson of Feridoon, made peace with Afrasial, the Scythian invader, one of the articles of the treaty was that Persia should have all the country to the north-east, over which an arrow could be shot from Demavend. A hero named Arish ascended to the top of the mountain, and shot an arrow to the banks of the Oxus, a distance of between five and six hundred miles. One Persian author, in relating this fact, states that the arrow, which was discharged at sunrise, did not fall until noon! and another author of high reputation informs us that the festival of the arrow, on the 13th of October, which is still kept by the followers of Zoroaster, is in consequence of this event. Neither historian states from what kind of bow this was shot; the

[a] Vol. ii. p. 104.

general tenor of the story would seem to indicate the *long bow*. The English archers, justly celebrated as they were for the long range and precision of their shots, could not accomplish more than 600 yards, at least, except on a few extraordinary occasions. The greatest range which our modern English archers can accomplish is from 300 to 500 yards. The Turkish ambassador, when in England in 1795, sent an arrow upwards of 480 yards, in the presence of several members of the Toxopholite Society[a]. His bow was made of horn, and is still in their possession. This was considered a very long shot; yet there are two or three on record, as occurring since archery has been merely a pastime, which have exceeded it by twenty or thirty yards[b].

With regard to extraordinary feats of correct aim, history affords us several instances. The story of Astor of Amphipolis and Philip is well known, but savours a good deal of the improbable. The reputed feats of Domitian in archery are more worthy our credence. He would frequently, it is said, cause one of his slaves to stand at a great distance, with his hand spread as a mark, and would shoot his arrows so correctly as to drive them between his fingers. Commodus too was a very expert archer, and with an arrow headed with a semicircular cutting edge, he could sever the neck of a bird. The story of William Tell is known to every one, and generally regarded in the light of an historical fact: this, however, does not seem likely to be the case, there being many reasons to suppose that his historian borrowed the tale from a Danish story related by Saxo-Grammaticus, who wrote in the 12th century. This very feat he states to have been performed by *Toko*, a Dane[c].

In illustration of our subject, we shall be pardoned for making a pretty long extract from Garrick's collection of old plays, where there are found two legends relative to the skill of English archers. The first is related in a ballad of eight fyttes or parts, entitled "A Merry Geste of Robin Hode." According to the story, the king (Edward IV.) disguised himself as an abbot, and paid Robin a visit. The outlaw, by way of entertainment, proposed a shooting match. He set up two wands, but so far removed from each other that the king made some objections: but we will quote the ballad.

[a] The Turkish Ambassador's secretary said that the (then) present Grand Sultan shoots 500 yards, which is the greatest performance of the modern Turks; but that pillars stand on a plain near Constantinople commemorating ancient distances, about 600 yards. (Mem. Mr. Jones at Mr. Waring's, an. 1796.)—*Banks. MS. Mus. Brit.*

[b] There is a tradition, that an attorney of Wigan, in Lancashire, shot a mile in three flights. By 33 Hen. VIII., no one aged twenty-four is to shoot at any mark under eleven score yards.

[c] Tales and Popular Fictions, &c., by Thomas Keightley, 1834.

"By fifty space our kynge sayde
The markes were too longe.
On every syde a rose garlande
The shot under the lyne.
Whoso faileth of the rose garland, said Robyn,
His takyll he shall tyne[a],
And yelde it to his maister
Be it never so fine.
Twyse Robyn shot about
And ever he cleved the wande."

Little John, Scathelocke, and Gilbert did the same; but

"At the last shot that Robyn shot
For all his frendes fore,
Yet he fayled of the garland
Three fyngers and more."

Of course he forfeited his "takyl," which he consequently presented to the disguised king.

The second ballad refers to Adam Bell, Clym of the Cloughe, and William Cloudesdale; archers as celebrated in the northern, as Robin Hood was in the midland counties. The king is represented in company with these worthies, and the royal archers having set up the marks, Cloudesdale censured them, saying,

"I hold him never as good archer
That shoteth at buttes so wide;"

and having procured two "hasell roddes," he set them up, at the distance of four hundred yards from each other; his first attempt at shooting at them, contrary to the king's expectations, was successful, for it is said,

"Cloudsdale with a bearyng arrowe
Clave the wand in two."

The king was naturally much surprised at this exercise of skill, and told him he was the best archer he had ever seen. The brigand on this said he would show him a still more extraordinary proof of his talent, and tying his eldest son, a child of seven years old, to a stake, and placing an apple on his head, he retired one hundred and twenty paces from the child's back, and having cautioned the spectators to be silent, and his son to stand still,

"He then drewe out a faye brode arrowe,
His bowe was greate and longe,
He sette that arrowe in his bowe
That was both styffe and stronge.

"Then Cloudesdale cleft the apple in two,
As many a man might se,
Over Gods forbode[b]! sayde the king,
That thou shode shote at me!"

These quotations are not made with the view of their being

[a] *i. e.* shall lose it. [b] God forbid!

received as undoubted historical records, but popular traditions are nevertheless valuable in giving breadth and tone to undisputed facts of a similar nature. Had these tales been egregiously beyond the limits of probability, they could scarcely have succeeded as popular ballads intended for the age in which they were made. Indeed, history would seem rather to strengthen the probability of the skilful archery just mentioned. *Carew*, speaking of the skill of the Cornish archers[a] two centuries back, says, "For long shooting, their shaft was a cloth yard in length, and their prickes twenty-four score paces, equal to 480 yards, and for strength they would pierce any ordinary armour; and one Robert Arundell, whom I well knew, could shoot twelve score paces with his right hand, with his left, and from behind his head." Another anecdote of the skill of the Cornish archers is related in the life of Henry VIII., by Hall. "There came to his grace, (the king,) a certayn man with a bowe and arrowe, and he desired his grace to take the muster of hym and to see him shoote; for that tyme his grace was contented; the man put hys one fote in his bosome and so dyd shoote, and shote a very good shote, and well towardes hys marke; whereof not onely his grace, but all others greatly merveyled; so the kynge gave him a rewarde, and for this curious feate he afterwards obtained the bye name of Fote in Bosome."

The bow now having become a mere toy, it would be highly interesting to know the amount of force with which our renowned archers could formerly hit an object at a given distance. A journal of King Edward VI. partly supplies us with this information. His majesty relates that 100 archers of his guard shot before him two arrows, and afterwards altogether, the object aimed at was a well seasoned deal board, an inch in thickness: many arrows pierced it quite through, and some stuck in another board on the other side. Unfortunately, the distance is not mentioned, but we know that Henry VIII. prohibited any one above the age of twenty-four years to shoot at a mark at a less distance than 220 yards[b], and we may presume that professed archers, on such an occasion as a trial of skill, in presence of their king, would shoot at a much longer distance than the legal minimum.

It might be imagined that the cross bow, bent as it was by the aid of machinery, would be capable of projecting an arrow further than the long bow; such, however, does not seem to have been the case. According to Sir John Smith[c], a cross bow will kill point blank between forty and sixty yards, and if elevated, six, seven, or eight score yards, and even farther. Mons. William de Bellay[d] gives the cross bow a still greater range, and says that

[a] Survey of Cornwall, 1602.
[b] 33 Henry VIII.
[c] Instructions and Observations, &c., p. 204.
[d] Instructions for the Wars, 1569.

if archers, and cross bow men, could carry about their provision for their bows and cross bows as easily as harquebusiers do for their harquebus, he would prefer the former weapon over the latter. He states, moreover, that cross bowmen and archers would kill at 100 or 200 paces, as surely as the best harquebusier. On the whole, it appears that the cross bow was more certain of hitting a mark than the long bow, but could not be shot with such rapidity, nor would it throw so far. Cross bows not only shot arrows, but also darts, called *quarrels* or *carreaux*, from their heads, which were square pyramids of iron. They also shot stones and bullets. There were two sorts of cross bows used in the English service, one called latches, and the other prods. The Genoese were most expert in the use of this weapon.

Both archers and cross bowmen were subject to be greatly annoyed by the attack of cavalry. For the purpose of defending themselves under these circumstances, they were supplied with sharp stakes, which they planted in the ground, and presented to the advancing troops, after the plan of the modern bayonet. Very late, indeed, in the annals of archery, in the reign of Charles I., an individual called Neade, developed an exercise of bow and pike together. The evolutions were witnessed by the king, in St. James's Park, were approved by him, and ordered to be taught throughout England; but political storms would appear to have prevented the execution of this mandate[a]. For the amusement of the curious, we append the words of command for this exercise.

Order your pike.	Fasten your bow.
Slope your pike.	Recover your pike.
Unfasten your bow.	Advance your pike.
Draw out your arrow.	Come up to your close order.
Nock your arrow.	Charge your pike.
Shoot wholly together.	Recover your pike.
Port your pike and march.	Shoulder your pike and march.
Port your pike and retire.	Comport your pike and march.

Other testimony, indirect but authentic, may be adduced to show the great power of the long bow. We have before us a treatise on military surgery, by William Clowe, Surgeon to Queen Elizabeth[b]. In this book is related a case of injury from an arrow, which demonstrates the force with which the weapon was imbedded in the thigh bone, and the great difficulty experienced in extracting it. We shall make no apology

[a] The description of this exercise was printed in 1633, under the title of "The double armed Man."

[b] "A profitable and necessarie booke of observations for all those that are burned with the flame of gunpowder, &c., and also for curing of wounds made with musket, and caliver shot, and other weapons of warre commonly used at this day both by sea and land, as hereafter shall be declared. With an addition of most approved remedies, gathered for the good and comfort of many out of divers learned men, both old and new writers." 4to. 1637. *Black letter.*

for quoting this narrative, which is doubly interesting, showing as it does how a rude and empirical practice of surgery must have added to the danger of wounds in those days.

"*The cure of a servingman, which was shot into the leg with a sheafe arrow, and the head sticking in the bone.*

"A few yeares past, at a great mustering and training up of souldiers, at Pile End Greene, neere London: amongst those bands of trained men there was appointed a certain number of archers: who after they had marched a long time, in the end the bow-men were divided from the pike-men, and shot onely to trie and exercise their bowes: it chanced in their shooting at a marke, about sixe or seven-score off, by misfortune one of their arrowes did hit a gentleman's seruant called Master *Withipole* into the outside of his left legge, so that the shaft was firmly fixed in the bone, *yet being a good way off beyond the marke when he received this hurt.*" The italics are ours, not the author's. Here then is an instance of an arrow being embedded in the leg bone, (with what firmness we shall hereafter see,) at a distance, *a good way* beyond a hundred and forty yards. We will now resume the quotation. "There was at that time one in the field which professed surgerie, and proffered to dress the wounde, presently in the place where the patient was hurt: hee being in great paines, was glad of any helpe, and so permitted the fellow to dresse him, who forthwith did attempt to take out the arrowe, nothing regarding the renting or tearing of the muscles, but ouer-hastily, and unaduisedly did pull out the shaft, and left the arrowe-head fast fastened in the bone, being a barbed head, *as are commonly all our English sheafe arrowes.* After, willingly he would have excused the matter, and seemed to say, that the head was ill glued or fastened to the arrowe, and so he dressed the patient, to his friends' great disliking, for that the patient was immediately troubled, and molested with a hot distemperature, much pains, and innumerable swellings, which induced a feuer, and his stomacke clean taken from the meate. Then it was the will and pleasure of one Master *Spinola*, in Fenchurch Street, where I did dwell, to send for me, and there I found the surgeon, but his patient being in extreme paines: wherefore in my presence, for that they would be rid of this fellow, they said they were greatly aggrieved with him, and told him that he had stained his practice in preseruing, and dressing the patient so ill, and that his abuse was great, and deserved punishment. Then he went about to blear their eyes with a little beggarly eloquence, the which he had learned amongst a sort of treacherous runagates, counterfeit land lopers, sophisticall mounty-banks, cosening quacksaluers, and such like false ingling deceiuers, with their paradoxical innovations, whose native soile is to them a wilde cat, and who abuse all good artes wheresoeuer they come or abide. But to auert circumstances, I say, he vanished awaye in dark-

ness, as may appeare in my former bookes, where I have more at large spoken of him and other the like abusers, whose bloudy hands without knowledge, doe hazard the lives of many." Mr. Clowes, having thus abused his rival pretty copiously, yields to the torrent of his emotions, and rejoicing in his superiority over the other practitioner, favours us with no less than four stanzas of poetry, in glorification of himself, and depreciation of his rival. We shall take the liberty of omitting this effusion, and see what our surgeon does to extract the weapon. "I did put downe a probe," says he, "into the bottome of the wound, where manifestly I did feele the head fixed in the bone, and by reason the orifice of the wound was so straight and swolne, that I could not dilate any instrument sufficiently to apprehend and take hold of the arrowe head, therefore I was driuen to make reasonable large incision down to the bottome, and then did put into the place of my incision a dilatorium, to open the wound, and so presently took hold of the arrowe-head with a *rostrum gruinum*, and then moved it by little and little, so very gently with safety I tooke out the arrowe-head." He then details the progress of the case to its result, which was favourable, and proves that, for those days, he was a very accomplished surgeon.

We have given the foregoing description thus in detail, as throwing much light upon an interesting subject: among other things, it mentions a peculiarity of the English sheaf-arrow. Antiquarians have made inquiries relative to the difference between *flight arrows* and *sheaf arrows*. The latter are known to have been the shorter and heavier of the two, adapted for the purposes of war; whereas the former were longer and lighter, employed for shooting at a mark. Clowes gives us a further amount of information: he tells us that the English sheaf arrow was usually forked.

The old writer *Giraldus Cambrensis* relates instances of the force with which an arrow may be shot, much more extraordinary than any thing we have yet mentioned on the same subject. He says that some archers belonging to the *Venta*, a warlike tribe of Wales, shot at the oak doors of a portal, behind which certain soldiers had concealed themselves[*]. These doors were no less than four fingers in thickness, yet the arrows penetrated quite through. It is related also by William de Breusa, according to the same author, that, in a battle at which he was present, a Welshman having directed an arrow at a horse soldier, who was clad in armour, and had his leather coat underneath, the arrow pierced the man through the hip, penetrated the saddle, and mortally wounded the horse. Another Welsh soldier pinned a man through the hip to the saddle in a similar way, and with this addition, the man feeling the wound,

[*] Temp. Hen. II.

pulled the bridle and turned about, when immediately he received a second shaft, in the other hip, which fastened him to the saddle on that side also, in such a manner that he could not stir[a].

(To be continued.)

THE PIANO-FORTE,

ITS ORIGIN AND PRESENT STATE; WITH OBSERVATIONS UPON ITS UTILITY AND INFLUENCE, AND SUGGESTIONS FOR FORMING A CORRECT SELECTION OF AN INSTRUMENT.

By James Hine.

A complete history of the piano-forte, extending backward to its earliest and rudimental state, is still a *desideratum* in the records of inventions. A work so full of interest would demand for its performance a wide research into the remote ages of musical antiquity: each alteration to which the primary form of clavichord was submitted, would require to be traced with a minute care, which should distinguish between those changes which have sprung from the purely mechanical conceptions of the maker, and others which have been demanded by the expansion of idea in the composer. To illustrate our meaning:—The question (still agitated by piano-forte makers) whether the blow of the hammer upon the string should be struck from below or from above, is referable to the former class of alterations; and the gradual extension of the compass of the scale of the piano-forte, and generally, of its powers of expression, appertains to the latter.

It is unnecessary for our purpose to enter into a detailed examination of the forms and construction of the clavichord, the virginal, the spinet, or the harpsichord[b]. At the same time, we cannot pass them by wholly unnoticed. The early form of these instruments was tabular; the strings, which were in compass about four octaves, were struck by small tongues or wedges of brass, set in motion by keys. In the spinet (from *spina*, a thorn) and harpsichord, a quill was substituted for the brass wedge. In all but the latter form of instrument there was but one string to each note, the volume of sound seeming to have been but of secondary importance. Yet, feeble as must have been the tone, those used in convents by the nuns were provided with an apparatus for stifling the noise, lest it should intrude upon the devotions

[a] Itinerar. Cambriæ, Gir. Camb. p. 835—20.

Those who wish for further information on the power of the bow, may refer to *Froissart's Chronicles*, *Ascham's Toxophilus*, the various treatises on war of *Sir J. Smyth, Knt.*, *Philip de Commie* on archery (temp. Hen. VI.), *Markham's Art of Archery*, and *the Banksian MS.* on the same subject.

[b] By a drawing preserved in Sir John Hawkins's Hist. of Music, vol. ii. p. 442, 4to, it appears that an early form of harpsichord was the perpendicular; whence perhaps its name.

of the adjacent sisters. A more effectual method of preventing such an interruption, in the present day, would be found in Mr. Wornum's ingenious Pocket Grand Piano-fortes, in which the superincumbent strings were removeable from all contact with the hammers, by raising the upper portion of the body of the instrument.

But whatever might be the amount of sound which was elicited by the touch of the player, the resonance of the string remained uncontrolled by any mechanical contrivance. Gradually, attempts were made, by the application of cloth and leather to the extremities of the strings, and to other portions of the machinery, to obviate the jarring of the wires; but the merit of wholly arresting the superfluous vibration of the string, was reserved for a later period. The clavichord, virginal, and spinet, each in turn yielded to its successor, until the harpsichord, in which each key was brought to act upon two or three strings simultaneously, assumed that preeminence over the spinet which the grand piano now holds among its smaller brethren:—

"Velut inter ignes Luna minores."

But, with all its improvements as to power of sound, there remained in the harpsichord the radical defects of its predecessors: the offensive twang of the wire, plucked by the quill, and the prolonged resonance of the strings. The remedy of these evils attracted the attention of the ingenious in divers parts of Europe during the early part of the last century; and the honour of that invention, which succeeded in overthrowing them, is contested by at least two names,—Wood and Schrœter; the former an English monk in Rome, the latter a Bohemian musician of no ordinary attainments. The public voice is more strongly in favour of the latter. We proceed now to show in what consisted that important alteration which opened the way to the production of the class of instruments now known among us, (by a name derived from the control which they give to the player over the quantity of sound he may desire to produce,) as "piano-fortes."

The first step in this improvement, was the substitution of the hammer[a] (the use of which had been hitherto confined to that rude and elementary instrument, the dulcimer) for the quill. By this process, a firmer and rounder tone was secured, as well as a power of mitigating or increasing the force of the blow. The hammers were covered with leather, to prevent all jar upon the string, and were secured by their position from reiterating the sound. But one of the defects of the harpsichord class still remained,—the prolonged vibration of the string. To correct this, a small jack was applied to the upper surface of each

[a] "Le précieux avantage du *marteau* est d'être aux ordres de celui qui sait le maîtriser. Il reçoit du tact du pianiste une sorte d'animation magique qui fait que le son prend successivement tous le caractères."—*Encyclopédie.*

string, moving in concert with the hammer, and descending upon the string as soon as the blow had been struck and the finger removed from the key. This apparatus is known by the term "dampers." The effect of these inventions was instantaneously felt. A patent of nobility was, as it were, conferred upon the new instrument. That genius, the traces of which yet dwell among us under the names of Haydn and Mozart, seized at once upon its attributes, and suggested still further improvements by the impressive inspirations of their master-minds. There needs but a passing comparison of the productions of the last of the harpsichord-school of composers with those of the piano-forte class, immediately following them, to discover how much the composer owed to the inventor; as in the subsequent progress of the improvements in the instrument we may trace, although more occultly, the conceptions of the composer suggesting the means for their fulfilment. It is a remarkable characteristic of the piano-forte, that its triumphant position should have been achieved through its mechanism only. On other musical instruments, the player is all but every thing in the estimation of his audience; the instrument becomes part of the man. The most simple strain breathed through an oboe, or drawn from a violin, appeals at once to the tenderest feelings, while, hitherto, the *plectric* class have suggested little beyond the idea of ingenuity in the performance. How often, in listening to the noble strains in the piano-forte works of Beethoven, have we been led to exclaim, "What a passage for the clarinet!—How fine a point for the violins!—How orchestral that effect!" Thus treating the piano-forte as at best but a substitute for the more transcendent enjoyment of the orchestra. The dampers were set in motion by a leverage, to which the name of "pedals" was given; it was soon extended in its application: after several attempts, that plan which is now generally adopted, was discovered, the effect of which is to remove the blow of the hammer from one or more of the strings of a note, when the form of the instrument will allow the space necessary for the action. This last-named pedal afforded a means of reducing, as the former of increasing, the volume of sound, and of producing a variety in the tone itself, closely resembling the harmonic sounds of the harp [a].

Our readers are well aware that some of the most beautiful effects in modern piano-forte playing are attributable to the

[a] "La couleur lui est donnée par les jeux différens qui composent le piano-forte, et qui sont mus par l'action des pédales. Celle qui lève les étouffoirs fait du piano un instrument à sons beaucoup plus forts et plus prolongés, mais pas soutenus au même degré, et qui, lorsque l'on frappe avec force, peut s'employer dans les momens qui demandent de la vigueur, et surtout un trouble bruyant voisin de la confusion. Mais, par un tact plus doux, le jeu qui résulte des étouffoirs levés peut aider puissamment à imiter la voix dans le soutenu du *cantabile*."—*Encyclopédie*.

judicious use of this invention [a]. We may point to Thalberg's "Prayer from Mose in Egitto," as an instance of these most valuable qualities in modern piano-fortes.

Having arrived at these important results, which have come to be deemed essential to the idea of a piano-forte,—having adapted them to a diversity of shapes,—the grand, the square, the vertical, the horizontal, it remained for inventors to ascertain, by mathematical investigation and practical experiment, the most effective mode of striking the string, and obtaining and controlling the greatest body of tone. This latter result depended upon the size of the wire with which each note was strung, upon the area of the sounding-board, and upon the action of the hammer. Of this there are two distinct functions,—the first, to strike the string with the precise amount of force desired by the player; the second, to strike it as often and as rapidly as the composer has indicated. The best method of imparting the power to effect these two operations, has afforded a wide field for inquiry. Many very beautiful contrivances, more or less complex, have been resorted to, by which lightness of touch, rapidity of execution, and clearness of utterance, have been secured to an extent almost incredible. To the attainment of the power of reiterating the blow with the greatest celerity and delicacy, a faculty so frequently called into action by the piano-forte writers of the day, immense labour and study have been devoted. To obtain this end, the great houses of Broadwood, Collard, and Erard, have directed their efforts, until by various means, in which it is difficult to find the absolute superiority of one beyond the other, the closest sympathy between the touch of the player, be it light or firm, and the action of the hammer, has been secured. Those of our readers who are acquainted only with this quality of the piano-forte, (the repetition of a note,) as it exists upon instruments ten or twelve years old, can have no idea of the near approach to the *vibrato* of the voice or violin which such means as those employed by Messrs. Collard can effect. The above-named distinguished makers have all followed up in an honourable competition, at great cost, every invention which could tend towards the perfection of the piano-forte. The results of their enterprise are amply recognised by the public in a large and liberal patronage.

As these observations upon the manufacture of piano-fortes, are intended for the information of the amateur rather than of the operative, we must abstain from any enlarged analysis of the varied forms of structure which the different manufacturers have adopted. In fact, it would be difficult to render intelligible

[a] "La charlatanisme abuse de ces divers moyens pour fasciner les yeux ou tromper les oreilles sur son défaut de science et d'habilité réelle; mais cela ne doit pas empêcher les grands pianistes de tirer parti des ressources précieuses qu'offrent ces différens jeux, soit mêlés, soit a part l'un de l'autre." —*Encyclopédie.*

by mere description, and without the aid of numerous diagrams, the many nice mechanical processes by which the *action* of the piano-forte has been matured to its present state of excellence.

It would be almost impossible, when all are striving after improvement, to point definitively to any maker as superior to others [a]: so difficult would it prove to decide, upon mechanical grounds, between the instruments of the above-named houses, for instance, that we feel called upon to urge our readers to refer the question to the judgment of their own feelings. The great professors who have from time to time visited this country, have by their productions and performances given an impulse in different directions to the inventive powers of the manufacturers of piano-fortes. Hence, some have devoted their attention to the production of instruments possessing a full deep tone, which is in accordance with the style of the graver composers: others have aimed at greater volubility and brilliancy, to suit the demands of the lighter authors. Some have approached the solemnity of the organ, others the *eclat* of an orchestra. Some have imparted a voice-like quality of tone; others a sharp and metallic. This diversity can be met only by a decision such as we have indicated; or by a compromise which will place the selection upon that instrument, in which all these attributes are most equally collected. The first point in choosing, relates to the class of instrument. This, we assume to be a "grand,"—horizontal, of course. If the touch of the player is bold, firm, and rapid, and there be room enough for the tone, we should suggest an "Erard." If, on the other hand, the train of musical sentiment be more tranquil, "Broadwood" must be resorted to. "Collard" will best supply the wants of those who may be called the middle class of *dilettanti;* whose taste is spread over a diversified range. In brief, the same rule which would guide the amateur in his decision between an Amati, a Straduarius, or a Guanerius violin, should be recognised in the selection of a Broadwood, a Collard, or an Erard; the amount of sympathy between the taste of the player and the tone of the instrument being the index of the choice. The greatest caution ought to be exercised in

[a] We may take occasion here to observe, without desiring to press upon the smaller class of manufacturers, that a really good piano-forte must be necessarily obtainable only at a large establishment. The amount of capital required to maintain a stock of materials in a fit state for immediate use; to pay the best wages to the best workmen in every department; to offer premiums and rewards for inventions or improvements, precludes all chance of competition to those of small pecuniary resources. Each of the principal manufactories may be assumed to give *direct* employment to 150 hands, (exclusive of porters and carters,) and *indirect* to carvers, metal platemakes, wire-workers, and other artizans, of whom no estimate can be made. The number of instruments of various classes, made by these firms, during the last 25 years, very far exceeds 100,000.

choosing instruments, in other than the repositories of the makers, or of those accredited by them. A system of imposing spurious instruments upon the public, by means of forged labels, was some years ago detected, and it is feared that it is not wholly eradicated. With respect to the exclusive preference for the instruments of particular manufacturers, occasionally exhibited by professors, we will assume it to be the result of conviction; but we venture to recommend them, as a means of ensuring satisfaction to those for whom they act, to have regard to the principles of selection which we have suggested above; by consulting the tastes and styles of their clients.

If a "GRAND" be, for the present, unattainable; we would not advise any compromise; but recommend at once the "SQUARE" with the *action* of the GRAND. The intervening classes, whether they be bichorda, semi-grand, pocket-grand, or any other modification of the grand, however excellent in workmanship, carry pretence upon their very front. The forms of instruments of this intermediate class suggest expectations which their powers are unable to satisfy; while, on the other hand, the powers of the grand-square far exceed the anticipations of the hearer. The classes of upright piano-fortes, are to be viewed with a consideration of their usefulness, rather than for their intrinsic merits. Convenience and ornament must be allowed as their strongest pleas. Nevertheless, the greatest improvements have been made of late years in them all. The cabinet, the largest of the classes, is rapidly disappearing; while the smallest class is as rapidly increasing in demand. In the latter class, both touch and tone have been brought to a high degree of perfection. In the smallest of these classes, the defective tone of the bass-strings has been the object of great attention on the part of the makers. The *vibrating* portion of them has been enlarged by several successful expedients; among which the diagonal position, employed by Tomkinson in his Pianette, may be mentioned; and a lighter and more equal touch has been obtained, by ingeniously articulated processes for connecting the hammer with the keys.

Among the many claimants for public regard, an instrument, called by the inventor the "Euphonicon," is entitled to notice. We have before directed attention to it, and we repeat the invitation the more earnestly, that public opinion is divided upon its merits. It is externally an union of the harp with the horizontal piano, the space below the key-board being closed in; the back of the inclosure consisting of three separate sounding-boards, from which all the weight of the tension of the strings is removed. These separate sounding-boards are also of unequal dimensions, observing a certain ratio to each other, and to the corresponding parts of the scale or key-board. At the back of the key-board, rises the comb of a harp, in which are set the pins,

round which passes an entire string, forming *two* by its return; the pins for securing the strings and tuning them, are conveniently disposed in the lower part of the instrument. The upper portion of the longer, or bass strings, is exposed to the air; while the whole of the shorter strings are confined in the body of the instrument. The inventor, in challenging for his invention a superiority over every other form of piano-forte, has undertaken a fearful encounter. We say nothing of the amount of prejudice which naturally would attend so great an innovation, but we proceed to state those imperfections which have been attributed to the construction of the instrument. The first is, that its tone is unequal in quantity and character; the sounds obtained from the inclosed portion differing in these respects most perceptibly from those of the open part of the strings. Secondly, that the reverberator, or sounding-board, is injured by the subdivision of its surface; and that much of the vibration of the longer chords necessarily passes without reflection. To these serious objections, the weight of which will not be counterbalanced by novelty of form or splendour of decoration, may be added the difficulty of keeping the instrument well in tune; so large a portion of the wires being exposed to all the atmospheric changes. Our own experience leads us to confirm them, and to class the invention among things "desirable" rather than "accomplished."

In contradistinction to the "Euphonicon," which boldly and undisguisedly avows its functions, may be mentioned those instruments of harmony, the abundant fruits of M. Pape's fertile invention, which lurk about, in society, under the disguises of loo-tables and sofa-tables, consoles and other capricious forms. In all these, there is but little beyond the idea to call for admiration or attention, even the novelty of which may be disputed; for we read of a *Regale* (a kind of portable organ of the 16th century) being so constructed, as to form, when shut up, a cushion or seat.

In guiding attention to the best classes of piano-fortes produced by the leading manufacturers, we have endeavoured to avoid all ground of offence to those, the results of whose labours we have been compelled to pass by in silence. It would be impossible, in an article of so general a kind as the present, to point out minutely the many highly ingenious refinements which the instruments of other extensive manufacturers present. To the amateur, the names of Stodart, Tomkinson, Wornum, and others, are rendered familiar by the important improvements which they have made in the different details of this most interesting branch of British commerce. These improvements would more satisfactorily form the subject of separate notices, than be included in the present. Our pages are ever open to any descriptions of improvements; and to none would we more cheerfully afford admission than to those which indicated the

progressive perfection of that instrument which has done such ample and ever extending service to the art and science of music. Nor, if the "MYTHUS" of the ancients be followed, which exhibited the symbolized arts as sisters all united, is the benefit of that service limited to music. How much of general intellectual culture is due to the introduction of music into the bosom of families! How much of historical, national, nay, of moral and religious instruction, may be referred to her presence! To her, in all ages, the good and great have turned for solace, and for the suggestion of that quietude which prepares the mind for holy thought. Shall we withhold then from the many, now that access is so widely facilitated, that which was of old the joy of the few? The greatest and most valuable aid in the diffusion of musical knowledge is, without doubt, the piano-forte. Its powers of expression, its clearness of accent, its portability, and its variety of form, all combine to render it invaluable to every class of society. It affords us great pleasure to record the fact that music, and particularly the study of the piano-forte, has assumed a more worthy position in the higher walks of manly education. The Universities of England abound in evidences of this pleasing truth. It is not to be desired that any constrained attention to this art should be required within the walls of Oxford or Cambridge; but the art itself should be rendered accessible, and its cultivation made an object of interest, by urging the Professors of Music, in those seats of mental culture, to step forth from their retirement and vindicate the claims of the mistress whom they serve, faithfully, perhaps, but too much *sub silentio*.

Lately, the piano-forte has been employed at the meetings of the great choral classes, by Mr. and Mrs. Hullah, with a success which has inspired a new zeal into their disciples. We should be glad to find that some steps towards imparting a practical knowledge of the piano-forte had been sanctioned by the Educational Committee. We would have a certain degree of acquaintance with this instrument rendered generally attainable upon moderate terms; and we feel sure that a sufficient supply of instruments fit for the service might be obtained at very reasonable prices. That the time for this result will arrive we have no doubt. Looking to the immense strides which have recently been made in the diffusion of knowledge and taste, we do not see how limits are to be assigned to that diffusion. And we are sure that, as it is now the recognised duty of the government to take every care that facilities be afforded for the attainment of so beneficial an object, it is no less so to urge the advancement in those directions which most tend to waken ingenuity, and encourage national industry. In our manufacture of piano-fortes, while many improvements in the instrument may be due to the ingenuity of foreigners—(we have seen that the original invention has been claimed for an Englishman,)—while we are com-

pelled to yield to them the palm as composers and performers, we still maintain our commercial superiority; based upon the soundness of our materials, and the stability of our workmanship. The markets of the whole world are open to this article of British produce.

We feel that we have very inadequately addressed ourselves to this interesting subject; the matter of which spreads out into so wide and so complicated a mass of branches, as to require far more space and other means of illustration than we have at our disposal, or can afford to it in our pages. We trust, however, that enough has been said to awaken attention, and to convince the reader that the history of an instrument so important, both in a musical and mechanical point of view, is, as we started with observing, a *desideratum* in the records of invention.

THE WARNER CORRESPONDENCE.

A MASS of letters which have passed between her Majesty's government and Captain Warner, with the minutes of the proceedings of the Commissioners appointed to enquire into his inventions, have been printed, in return to an order of the House of Commons. The correspondence has been carried on since the first day of September, 1841. A more extraordinary collection of documents has seldom been laid upon the table, and they certainly exonerate her Majesty's government from any blame for not offering to Captain Warner ample opportunities of proving the reality of his assertions, whilst they throw the utmost suspicion upon his capability of effecting what he promises. The boldest assertions, based upon no proof whatever, the most evasive retreats from the completion of his promises, are visible at every step. It is a matter of no small difficulty to wade through this correspondence, analyze it, and lay it before the public in such a form as to give a satisfactory view of all the steps that have been taken by the government to arrive at just conclusions, and at the same time to shew the endeavours to separate the unqualified demands of Captain Warner for belief in his loudly proclaimed powers, from whatever knowledge he may possess of some as yet unknown explosive agent. Throughout the whole of the negociations, we are happy to observe that the utmost courtesy has been shewn to the inventor, that no means have been had recourse to for the purpose of discovering his secrets, and that whatever he has advanced, has been listened to with calm and polite attention. The task of settling the compensation and purchase of a secret is no doubt most difficult; the negociations must necessarily be protracted, and many misunderstandings must arise; but we think that, on every occasion, Captain Warner has been the cause of breaking off the

treaty, and of unsettling the arrangements just at the precise moment, when we were led, from the correspondence, to the belief that every thing was definitely settled. The abrupt termination of the first commission, just when every thing had been brought apparently to a satisfactory conclusion, reflects no credit whatever on Captain Warner. He had held a personal communication with its members; had answered, certainly in a most evasive manner, the questions applied to him; and suddenly declined performing what he had undertaken, because they stated that they had not the authority to enter into an agreement as to reward or remuneration, he knowing that to higher quarters he was to look for the carrying out that part of the arrangements. It is much to be lamented that so much mystery attends all the first steps taken by Captain Warner, and that they have been, by unforeseen circumstances, so involved in darkness, as to be suspicious. All the early history is apocryphal. He states that, about 12 years ago, he destroyed two vessels, of which remarkable event no trace has been left; the date, the particulars, the name of the only man who was a witness to these startling circumstances, was promised to be given by Captain Warner, on the 19th of April, 1842, on the following day: we have no such entry made. From a Portuguese schooner, at a distance of six miles, he shivered several tons of rock at the Bayonne Islands, whilst at a distance of three miles he split three trees. These, it seems, are the only trials he has ever made of his wonderful powers; yet upon these he builds his proofs that he could blow up the foundation of the battery at Gibraltar, called the Devil's Tongue. In fact, he has, excepting from his own belief in his agents, nothing to produce that could prove satisfactory to the least enquiring mind. Unfortunately, all those to whom he appeals are dead. The admiral, who saw the long range tried, is no more. His late Majesty, who is said to have taken an extraordinary interest, seems to have communicated his feelings to no one on the subject. Of those who were acquainted with his proceedings, we have only to say, that they were not those upon whose judgment much reliance could be placed. Lieutenant Webster, to whom an appeal was made, was not a person at all calculated for that calm investigation, and deliberate attention, which are necessary to ensure our belief, or one upon whose authority any thing might be credited. A kinder-hearted man, but a more credulous one, never existed. He had a heated imagination, which led him to errors fatal to his own comfort. He had been an enthusiastic prophesier of immense wealth to England, from the mines of Mexico, and had some years before led his friends into great error, from his having constantly in his mouth, "rich veins, incalculable mines of wealth, largest fortunes in the world from the United Mexican mines," just as he had two or three years since the words "tremendous power,"

"wonderful explosion," "Captain Warner's terrific engines," without being enabled to convey any definite idea of what he had seen or what had been done. We regretted, however, to observe in the Parliamentary Reports, that Sir Charles Napier designated him as a twaddler. He was easily to be imposed on, knew little of modern improvements, but was one of those well-disposed, easily managed persons, for whom we always entertain the kindest feelings, but not the profoundest respect.

The ministers, and the commissions appointed, were very naturally desirous to have the long range brought before them; for well aware that explosive shells have been frequently tried, and are not all difficult to manage, they were unwilling to incur any expense in the examination. Captain Warner, however, always insisted upon the invisible shells being first experimented on, and constantly asserted that five thousand pounds were necessary for the trials. After having stated that he would, however, undertake it, if five hundred pounds were advanced, he abruptly brings the affair to a conclusion, upon the plea that he cannot find fifteen hundred more, to make up a sum requisite for his shewing of what he is capable.

His letters are most plausibly written, and whilst they loudly and boldly vaunt his capabilities, are sadly contrasted with the memorandums of his interviews with the commissioners. The answers personally given by him are completely at variance with his letters. The stupendous power seems scarcely to have been tried; and whilst his invisible shells are proclaimed to be fitted for storms, for tides, for alterations of depth of water, when he is writing about them, yet when giving his oral testimony, he declares he did not intend them for tideways, or where there was any rise or fall of tide. Indeed, the discrepancies are of a character so extraordinary, that the greatest suspicion falls upon all his statements. We should be glad to have found Sir Robert Peel a little more familiar with some of the rudiments of chemistry; we had looked upon him as an alchemist of the first class, for he had by a breath converted eight hundred millions of paper into that amount of gold; but when we find him recommending the Board of Ordnance to make a shell of lunar caustic, for the purpose of having a powerful explosive, we have to regret that he has never attended a course of lectures, to place him on a par with the veriest tyro of a Mechanics' Institute, who would have told him that the properties of nitrate of silver are essentially different, and could never form an ingredient of an explosive composition. We hope that chemistry will be taught to the classic youths at Harrow, that they may not exhibit to the world what may appear to be unjustifiable ignorance.

The first letters occur in October, 1841, from Sir Robert Peel to Sir George Murray and Capt. Warner; the former recommends the investigation of the inventions, first, as regards their destruc-

tive power, and then their application with safety to the party using it. A memorandum is next given, drawn up by Sir George Murray, defining the points to be attended to, which he limits, first, to the power; then to the degree of safety and facility with which it may be applied; and lastly, to the detriment which might result from the communication of the secret to foreign governments. He states his reasons for giving ample compensation to Mr. Warner, and calls upon the government to bear the expense of the trials.

We have next a letter from Sir George Murray to the Earl of Hardwicke, and its answer, in which Colonel Pasley and Sir T. Hastings are mentioned by Sir George as the officers whose opinions would be relied upon, and the communication of this choice by the Earl of Hardwicke, as a friend, to Capt. Warner, who objects to them both.

We then have placed before us a letter from Capt. Warner, addressed to the Earl of Hardwicke, in which is submitted his statement of the powers of his inventions. He says, that for upwards of ten years he has been subjected to disappointments and suspense, the consequence of which is pecuniary embarrassment. He was, in the year 1830, about to take a command under a foreign power, when his inventions became known to his late majesty, who honoured him with a command to communicate the nature of his discoveries to Admiral Sir Richard Keats, and during two years he was occupied in a series of explanations and experiments, which proved not only satisfactory to that gallant officer, but likewise to Admiral Sir Thomas Hardy. He then entered the service of Don Pedro. On his return, he was led to hope that his views would meet the attention of government; but a string of accidents and circumstances prevented the exhibition of his inventions before Sir Robert Stopford, whose departure for the Mediterranean again threw obstacles in the way. During three years, he had repeated interviews with Lord Melbourne and his secretary, Mr. Cowper, during which he repeatedly offered to show his experiments, but his overtures were invariably rejected. He declined to reveal his discoveries indiscriminately to a public board, or make open experiments at Woolwich or in Plumstead Marshes. At length, it was arranged that a naval officer of experience, and qualifications adequate to the task, should be selected to examine the projects, and report upon their character and merits. Lieutenant Webster, who was personally unknown to Capt. Warner, whose abilities as a seaman and naval officer, practically familiar with maritime warfare in all its branches, was declared to be a perfectly satisfactory judge upon the occasion. After this detail, he enters upon the power of his inventions. They are twofold,—the first are designated invisible shells; the second, the long range. By the means of the first, he declares that he can blockade the mouths of rivers, harbours,

and roadsteads, and any channel where the usual soundings can be made may be rendered impervious; the Straits of Dover might be rendered impassable; the Dardanelles, the entrance to Toulon Harbour, would with greater ease be blockaded; ingress and egress from the most important ports of the United Kingdom could be prevented; all fluctuations of tide and alterations in the depth of water are provided for, and time does not deteriorate the efficacy of these implements; if certain artifices of concealment, allowable in warfare, are resorted to, the enemy may be kept for ages in darkness as to the plans of operation. He states that Admiral Sir George Cockburn, the Earl of Hardwicke, Lord Ingestre, and Capt. Webster were present at an experiment in July, 1840. The gallant admiral expressed his astonishment at the stupendous power so promptly and easily called into action, but doubted its applicability on a large scale, and spoke of a committee as the only adequate tribunal to decide. This Capt. Warner regrets, as his doubts have done him damage in professional and official minds. He then expatiates upon the power he possesses of so environing a fleet that it could not get under weigh without certain destruction, and the same fate would occur if under sail, whatever be the state of the sea, the weather, the size and number of the ships, or the rate at which they may be moving. Not only in maritime warfare, but these shells are available against troops or forts. The land application is equally destructive.

The next topic is the long range. The warlike advantages secured by it are, says he, an extent of range exceeding by far that of any ordnance now in use by any nation on earth: to this preeminent advantage may be added, rapidity of fire, certainty of aim, freedom from recoil, and perfect safety to the vessel which carries and the crew which handles the implements. He repudiates the boast attributed to him of being enabled to blow up the rock of Gibraltar, but asserts that he could bring such a force to bear upon any fortress, as strong as Gibraltar,—such a fire, that in a few hours not a man should be left alive. In the highest sea, he can ensure his aim at a range beyond any distance hitherto attained by any battery afloat. He appeals to those whose names he has mentioned, as having witnessed his experiments, whether he could not have bombarded Acre from a single vessel, placed in security, out of the reach of the garrison artillery. He affirms that an ordinary ship's company can be readily and easily taught the use of the implements, and that they cannot discover the nature, construction, and animating principle of the impelling power. He proceeds to say, he is aware how startling and incredible these assertions must appear to those who think only of the agency of gunpowder, or whose knowledge does not go beyond the galvanic action, or dangerous and intractable fulminating sub-

stances. He relies upon years of experiment; upon being conversant with ships and the sea since he was ten years of age, and having experimentally proved every situation of difficulty which presents itself in the battle or in the storm; that he is not the dupe of his own excited imagination, but that he can perform all he professes. He then points out the importance to the country of his inventions, and the advantages in point of economy, which would have resulted during the war with Napoleon, had we been in possession of the knowledge of the long range. He feels he is now bound in honour and duty to disclose to her Majesty's government the extent of his amazing powers, which he has obtained after years of toil, study, and expense, aware that publishing such statements in the columns of a newspaper, or promulgating them to the multitude, would lead to his being derided as an impostor, or pitied as the dupe of his own fancies.

He then submits his terms to the government, leaving the mode of payment for future arrangement. £200,000 for the invisible shell; £200,000 for the long range; offering his personal services to carry his plans into operation, and disavowing any desire of a high rank in the navy.

We have next a letter from Lieut. Webster, addressed to Capt. Warner, detailing the steps which led to his becoming acquainted with the projects of the inventor, his interview with the Lords of the Admiralty, and his verbal report to them of the extraordinary effects he had witnessed. With this is given Lieut. Webster's letter to Lord Melbourne, reporting that he was convinced that nothing that floats can resist for a single moment, either at close quarters or any given distance, even to a range of five or six miles, Capt. Warner's operations. He distinctly expresses his opinion that the first power that possesses his secrets will have the absolute sovereignty of the seas in its hands. Besides bearing testimony to the value of these inventions, he urges the necessity of the nation's becoming their possessor.

We have then several letters upon the nomination of a commission, and at length Vice-Admiral Sir Edward Owen and Sir Howard Douglas were chosen by the government, and accepted by Capt. Warner. Sir Edward Owen, however, was called upon to enter into active service before the inquiry could be brought to a satisfactory conclusion. But, before leaving England, he communicated the impressions made on his mind by the interviews which he had had with Capt. Warner, which simply consists of observations on the assertions made of the infallibility of the machinery used, and the difficulty of finding a place for trial.

We have next a curious correspondence, consisting of three letters; one from Lieut. Webster, that he considered himself free to take advantage of the knowledge he had acquired of

Mr. Warner's inventions, and therefore that the estimate of their value was diminished. This was communicated by Sir George Murray to Sir Robert Peel, who nevertheless wishes the trials to proceed, although he thinks the value greatly abated.

On the departure of Sir Edward Owen, Sir Byam Martin became a member of the commission; some correspondence in the mean time passing on the subject of a request made by Capt. Warner, that either Lord Hardwicke or the Lord Ingestre should be added to the two officers already named. The commission then called upon Capt. Warner to furnish them with a memorandum of the expense which might attend his experiments, requiring the "long range" to be shown six times, the "invisible shells" three times. They leave him to fix the locality, and inquire what cannon and what assistance he may wish to have from the Admiralty. To this we have the reply, that he does not require either artillerymen or cannon; that he wishes the invisible shell to be experimented on first, then the long range; he thinks the repetition of the experiments unnecessary, as the First Lord of the Treasury, the Master General of the Ordnance, the senior naval Lord of the Admiralty, the Secretary of War, Lord Ingestre, have been eye-witnesses to his powers; that Sir James Graham knew that the late Sir Richard Keats had a favourable opinion of them. He then stipulates for a guarantee from the government of payment of a sum of money upon his disclosure of his secrets, and he will then proceed, at his own expense, to demonstrate the power of his long range.

The commission then state, that they are willing that the invisible shells should be first tried; their object having been, in making the first point of their attention the long range, to inquire into that which Captain Warner had stated in his papers to be of the greatest importance. They state that it would be an absurdity to be satisfied with the opinions of others, as the commission was appointed to witness and report upon the practical efficacy of the inventions, and they frankly state that they cannot permit themselves to be influenced by any thing which has hitherto occurred. They likewise observe, in answer to a part of his letter as to the testimony of those who have seen the actual power of explosion, being sufficient, without the repetition of an experiment at an unnecessary expense and loss of time, that it does not appear to them that those experiments have been made either on a scale or under circumstances which warrant a conclusion that the invisible shells are applicable or practicable under all the conditions and circumstances of real service; and that with respect to the prodigious powers of the long range, they have nothing but statements made, of so astonishing a nature as, by his own confession, to be incredible to those who have not witnessed them. With regard to the stipu-

lations for payment, they observe, that subject rests with her Majesty's ministers.

We have next a minute of proceedings at an interview of Captain Warner with the Commissioners, in which that gentleman, in answer to the questions put, says that he has been satisfied as to the power of the long range about twelve years; as to the invisible shells, twenty-seven or twenty-eight years; that he sank two privateers with them at the end of the war, one off Folkestone, the other in St. Valery Bay. He was on board the Nautilus, hired into the king's service by his father, about four years. He answered to the question, whether the Admiralty or Secretary of State had not been made aware of such an extraordinary circumstance, that it was not reported to the Admiralty, as they were not under it, and that he did not know whether it might have been reported to the Secretary of State; the facts were not recorded in the log-book of the Nautilus, for none was kept; no head-money for the crews of the privateers so destroyed was received, because none was claimed; none of the men of the privateers were saved, they were all blown up. No one knows any of the circumstances but myself and another man. He was then asked, "What is the name of the other man, and can you give the date and particulars of this extraordinary circumstance?" to which the reply was, "You shall know all to-morrow." He stated that his powers were tried in the presence of Sir Richard Keats and Sir Thomas Hardy, upon a farm belonging to his nephew, in Essex. In answer to a question thus put, "You say in your paper to Lord Hardwicke, 'I have frequently tried my powers, not in a model merely, but on a scale ample enough for real action; not once, and under favourable circumstances, but repeatedly, under varying circumstances,'—state when, where, and how frequently these trials took place, and what persons were present when you made these large experiments," he said, the long range was tried in the presence of Sir R. Keats, at a place called Anholt, and his gunner, John Goldsall, with a two-pounder, at a distance of three miles; that when speaking of its being tried under varying circumstances, he meant the sinking of the two privateers. His six-mile range he tried against the Bayonne Islands off Vigo; it knocked the rock about to a great extent, tore it up, and shivered several tons of the rock; its effect in Anholt Forest, at a range of three miles, was to split three trees in pieces. The next question was, "Can you give any distinct and positive proofs of the severe effects of your long range?" To this the reply was, "At the Bayonne Islands, at a distance of six miles, if there had been 100,000 men on the island, they would have been destroyed. I could sweep every creature from the rock of Gibraltar, and could blow up the foundations of the battery called the Devil's Tongue. It was from a Portuguese schooner, in Don Pedro's service, that I fired at the Bayonne

Islands, six miles' distance." He was then asked, "Have you, in point of fact, ever tried your long range against any ship or vessel, or building, so as to produce the destruction said to be in your power?" "No; but I undertake to forfeit my existence if I do not." Further questions being asked upon the subject of the long range, he said that the actual proofs of his power were obtained by trying it at the Bayonne Islands and in Anholt Forest; and as to whether he would go to Dimchurch, on the coast of Kent, where there is a small fort and building, that he could knock it all down and destroy Brighton in an hour. The invisible shells then became the subject of investigation, as to the means of securing them, their management during the rise of the tide, the manœuvring necessary to keep out of the way of the enemy, the degree of force required for explosion, the risk of detection, the secresy, and the expense.

The investigation was then drawn to a close, for Capt. Warner declined to proceed further until the commission received authority to promise him the remuneration he asked, in the event of his proving to their satisfaction the ability to effect what he proposed. The commission therefore drew up no report, but remarked that enough was stated, in the course of their examination of Mr. Warner, to leave an impression that the secret could not be kept exclusively for the country. That the stipulation Captain Warner seeks is calculated to obtain for him the public sympathy. They therefore propose that he should be urged to try experiments with the long range, and point out the dilapidated military defences at Dimchurch; and state that if he can actually destroy the work and its defences, at a distance of six miles, they will be satisfied that he will have established a claim to liberal reward for having performed that which, to use Mr. Warner's own words, is perfectly incredible.

As Mr. Warner's proposition was at variance with that which had been assented to by him, a correspondence took place upon Sir George Murray's memoranda; and it appearing to Captain Warner that he was refused any preliminary guarantee whatever, he "respectfully, but firmly and finally, declines proceeding with any further investigation" before the Commission.

On this, the functions of Sir Byam Martin and Sir Howard Douglas ceased. On their acknowledgement of the last letter written to them, they thus reply to a passage which occurs—"I put it to your candour whether I have not already made many important disclosures to yourselves."—"To this appeal we give a decided negative, not only for ourselves, but for the Commission as originally constituted; you have not made any important disclosures to us; you have made many assertions, but we have been afforded no opportunity of fulfilling the chief object of our commission, namely, the testing your discoveries by actual experiment." Captain Warner thinks that it was his misfortune to have to encounter a prepossession in the minds

of the commission, that he intended to deceive; and, in his next letter, expresses his feeling, that if he is driven out of his own course, his discoveries will become known to Europe. Further correspondence is carried on, and Captain Warner says that the charge made against him of bringing the negociation to an abrupt close is incorrect, and that the reason was the utter incompatibility, from the nature of the things themselves, of performing the experiments he was called upon to make by the Commissioners. He objects to the performing the experiments of the invisible shells three times in different depths of water—to exhibit his long range six times—from risk of disclosure. He is still ready to shew that he can with precision direct missiles the distances he before asserted, and authorizes Sir George Murray to disclose the agent employed by him to Sir Robert Peel. He lays no claim to scientific education, but to the possession of secrets of importance, and claims the protection which ought to be given to one who has laboured long and suffered severely. Ineffectual attempts having been made to revive the Commission in the persons of Sir Byam Martin and Sir Howard Douglas, who firmly declined all further duties, Sir George Murray endeavoured to find other gentlemen disposed to undertake them; having always had a sincere desire that Mr. Warner's discoveries should be turned to account. On this Captain Warner accepts the proposal, provided that he may name three officers from whom a third commissioner should be selected. At length, however, he agrees to submit his discoveries to two commissioners, Lieutenant-Colonel Chalmer, R.A., and Commander Caffin, R.N. They met on the 20th December, 1842, and the day being fixed, Captain Warner attended. He stated that he was not prepared to enter upon the long range; he produced drawings which illustrated the different modes of using his shells, but avoided throwing any light upon the invention. He insisted that they were purposely invented for the ports of the Mediterranean, where there is little or no tide. To all the questions put, mere extravagant assertions were given as answers, and he declared that the subject of remuneration was not to be discussed by them. A ten-gun brig was proposed to be used for experiments. Sir George Murray, on being applied to, placed it at the disposal of the commission, and five experiments were to be shown, for which Captain Warner required the sum of 2000*l.* Before this is granted, he was requested to give an estimate of the probable expense of his long range, and also to furnish a detail of the calculation of the expense for the invisible shell; to which he replied that the hiring of a steam vessel for a month would be 600*l.*, for the three first experiments 800*l.*, and for the two last 600*l.*; the expense for the long range requiring a personal interview as to the experiments to be performed.

On the 7th of April, the commission having met Captain

Warner, on this occasion the Captain was not prepared to enter upon the question of the long range, being most anxious that the invisible shells should be first tried. He was not prepared to state the sum required to carry out the experiments of the long range, as it must depend whether the apparatus was to be permanent or temporary; if permanently, he would have to build a steam ship which would throw out 100 of his destructive agents at a volley, and three volleys in a minute, to the distance of five or six miles; one of these balls was sufficient to destroy a ship. He said that he could destroy a ten-gun brig five miles off as easily as he could lay his hand upon the table, and that if fifty sail of line-of-battle ships were there, he would destroy every one of them. He was reminded that there existed no proof of this assertion, which set aside all our preconceived notions of the laws of resistance. His answer was, that both Sir Richard Keats and Sir Thomas Hardy had seen its devastating effects at a range of upwards of five miles, and that the force was a hundred times greater than that of gunpowder. The commissioners pointed out that the government would not be acting with caution if they did not know the probable expenditure. He stated that he was quite willing to carry out the investigation at his own cost, if he had a guarantee that he would be rewarded when completely successful. The principal part of the conversation on the invisible shells turned upon the assertions previously made of his powers, and upon his power of regulating them; though they were not intended for tideways, he could set aside that difficulty, and could cover the buoys which might be necessary with sea-weed, to deceive the enemy. A series of questions are propounded to Captain Warner in a letter. He accounts for the expenses attendant upon his experiments; alludes to the degree of disclosure to which he is to go. He first wishes an interview with Sir George Murray, and expresses his wish that, before the long range is entered upon, that the invisible shells be gone into. The commissioners then address Sir George Murray, inclosing the questions propounded to Captain Warner, and to which he promised answers on the 10th, and their memorandum upon the expense attendant upon the experiment; to which Sir George Murray replies, that as Captain Warner has already shown his experiments to Sir Richard Keats and Sir Sir Thomas Hardy, and fully satisfied them as to the applicability of his inventions, he ought to be aware of the actual cost of the investigations; that Sir George Murray could not recommend so large a sum as was required for the purpose of testing the least important portion of the invention. Upon this the commissioners urge Captain Warner to make his estimate for the long range, for without it their commission must necessarily terminate. To this Captain Warner replies, that he will proceed to make up an estimate, which will require four

days; that the experiments before the persons who are mentioned were simple demonstrations, and not upon the scale required by the commissioners. They then ask for an estimate of the expense of the experiments as shown to those persons. Captain Warner in his next letter gives the amount required, but declines entering into detail; he says that the effective exhibition must be on a scale ample enough to encounter an enemy. He requires 2000*l.*, and says that if the government was to prepare the requisite apparatus from the foundation, it would cost not less than 10,000*l.* He says that he could destroy a small cutter at a distance where she must be hull down, if his preparations were on adequate scale. He objects to the commissioners being on board his steamer whilst operating. He undertakes to perform the operations required, the commissioners being placed in a position to command a fair view of them. The cost of experiment before Sir Richard Keats was 1500*l.* The outlay necessary to fit a vessel against fleets, forts, or troops, on a line of coast, would be 30,000*l.*

Sir George Murray drew up a memorandum, and the commissioners a statement of preliminary arrangements, to be signed by Captain Warner, to be submitted to her Majesty's government. A correspondence then takes place between Sir George Murray and Sir Robert Peel upon the documents, from which it appeared that the negociation had arrived at that degree of maturity which justified the idea that it might be brought to a termination. Sir Robert Peel urges that the long range should be first tried; upon which still further letters pass from all parties, Captain Warner feeling both pain and disappointment that the arrangements should be disturbed by which priority should be given to the shells, which, he thinks, Sir Robert Peel does not sufficiently appreciate; and he calls upon the commissioners to explain to the minister their importance in a maritime point of view. He states that he has reconsidered his calculations, and cannot materially reduce the amount. The commissioners state that they cannot explain to Sir Robert Peel the value of the invention, as they know nothing of it beyond the impression conveyed by some rough sketches, and Captain Warner's assurance of its entire success. They also agree that the invisible shell was allowed priority, when they found that their efforts were unavailing to obtain the long range. Captain Warner writes to say that his final resolution is that the shells should be rejected or entertained before the long range, and will not retract his distinctly avowed resolution further than to say, that if the government rejects the shells and permits him to dispose of them as he pleases, he will then enter upon the experiments illustrative of the long range. He complains of the unreasonable protraction of the negociations, and wishes for a final answer.

In a conversation the Commissioners held with Mr. Warner,

he insisted on the priority of experiments with the shells, the expenditure of which would be 2,000*l.*; having carried these out, he would then require 1,500*l.* more for the long range. Sir Robert Peel not thinking it consistent with his duty to authorize the expenditure of 5,000*l.*, he is willing to expend a sum not exceeding 500*l.* for testing the value of the long range. Captain Warner, determined on trying the long range, says that if the Government will advance 500*l.*, he will be enabled, by the assistance of his friends, to raise the remainder of the sum required, but as it is uncertain when the additional sum may be obtained, he cannot name the period when he will be prepared. A letter from Sir G. Clerk announces that the Lords of the Treasury have placed at the disposal of the Committee 500*l.*, to ascertain the value of the long range. Captain Warner then addresses a letter to Sir Robert Peel, stating that he has been disappointed in raising the sum he had undertaken to make up; requesting the aid of the Government; and he "respectfully and temperately" warns the prime minister that for the sake of 1,500*l.* inventions of deep importance to the country will be lost. Sir Robert Peel refers him to the ordnance department. Captain Warner writes to Sir G. Murray, recapitulates what he has offered, and cannot reduce his estimate below 2,000*l.* He says he has made every concession demanded, has surrendered a guarantee, has left the appraisement of remuneration to the prime minister, but finds himself stopped on the very threshold of performance by want of funds. He communicates to the Commissioners the disappointment of his expectations to raise the sum, his address to Sir Robert Peel to enlarge the Treasury grant, and his writing to Sir G. Murray; and takes farewell of the Commissioners with heartfelt thanks for the courtesy and kindness he had received. Thus terminates a correspondence which for two years was carried on, and which we think exhibits, in a clear point of view, that, whatever explosive compound Captain Warner possesses, he is unwilling to try the long range. We are convinced that he has a heated imagination, and that he is led to believe that he possesses powers which have not been granted to man.

PATENTS.

No. III.

PAPERS ON THE PATENT LAWS AND INVENTIONS OF GREAT BRITAIN, AND ALL FOREIGN COUNTRIES GRANTING THE PRIVILEGES OF A BREVET.

COMMUNICATED BY MR. ALEXANDER PRINCE.

OFFICE FOR PATENTS, 14, LINCOLN'S INN FIELDS.

Specification of the Patent granted to WILLIAM WRIGHT, *of Duke Street, St. James's, in the county of Middlesex, Surgeon-Aurist, for "certain Improvements in rendering Leather Skins or Hides, impervious to wet, more flexible, and more durable."*—Sealed January 11th, 1844.

THIS patent is taken for the very important purpose of improving the constitution and condition of leather skins or hides, as taken from the common process of tanning and dressing, by subjecting them to a completely distinct process, by which they are rendered perfectly impervious to moisture; and by which, while receiving a character of greater flexibility than they possessed, in what may be termed their natural state, they also become more firm in their texture, and in this compounded improvement of flexibility and firmness, of consequence become more durable.

The modifications which the chemical knowledge of modern times has enabled us to produce in the practical qualities of leather, hides, and skins, constitute the valuable process we term tanning. The immense value to us of a certain means of rendering the raw skins of animals unalterable by the external natural agents which constantly tend to decompose them, has long been familiar to our every day experience, as regards its general use, but the more recent discovery of the manifest insufficiency of this process in extreme cases, to meet our new wants and refinement of comforts, and the remedial means by which to overcome the deficiency, may be said to rival the original discovery.

The preparation in a rude manner of the valuable substance leather, has been known from the most ancient times, but it was not till the end of the last and the beginning of the present century that the consideration of the scientific principles on which its manufacture ought to be conducted, began to engage the attention of chemists and philosophical men.

The process of tanning skins for leather has been conducted on principles which, although of similar tendency, and leading to the same practical results, are distinctly different in their details of proceeding. One of these, and which may be termed

the old process, is that longest in use, and may be designated the *slow process*, and this modern science has sought to improve by the adoption of a second, which is in contradistinction termed the *quick process*. Various mechanical and highly ingenious and effective methods have been devised, from time to time, to shorten the time required for the general process and to improve the result; but nothing effective seems to have been done by which a rapid process can be made to produce a leather equally durable and substantial as that produced by the slower proceeding. It is ascertained beyond a doubt, that the processes followed in the rapid method of tanning produce leather of much less durability and power of resistance to moisture, than the leather produced by the slower process. But the considerable saving of time in the operation, added to a great increase of product by weight, are strong temptations to manufacturers to adopt, within prudent limits, such modifications of the rapid process as may at least obviate the more dangerous and palpable mischief. It must, however, be admitted, that in the common and practical progress of any manufacture, the presence and example of a numerous body of men of scientific habits and high integrity, operates as a wholesome check upon ignorant practitioners, but yet does not afford an effective security against the introduction to the public market of inferior produce. Such, unfortunately, is the predicament in which the consumers of leather find themselves, as regards that indispensable article of every day use. Leather of imperfect and faulty character abounds, and a material really and truly impermeable to moisture (*practically waterproof*), as it ought to be, has been to the present hour a desideratum.

Hence the origin of the present patent, which, if it does not in its working produce by its reaction on the manufacturers of leather, a wholesome revolution in the art of tanning, will certainly most completely and effectively protect and guarantee the consumers of the material against the dangers that are so directly the consequences of its present imperfections and inefficiency.

Specification.—Now know ye, That in compliance with the said proviso, I, the said William Wright, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are fully shewn and ascertained in and by the following description thereof, that is to say:—

For convenience of description, I divide my invention into two parts. *First*, the compositions which I use, and *Second*, the manner in which I combine those compositions with leather skins, or leather hides. The compositions are thus made:—

Composition No. 1.—*First*, I take of linseed-oil, rape-oil, or neatsfoot-oil, twenty-five gallons, which I reduce by boiling to twenty gallons. *Secondly*, I take fat, such as bullocks',

sheep's, or deer's, drawn by gentle heat out of the cellular membrane, and strain it, and then I boil it in soft water for an hour; I again strain, and suffer it to stand until cold. All moisture must be carefully abstracted from the mass of fat, and by placing the cakes upon cotton cloths, the moisture, if any, is absorbed. *Thirdly*, I add forty pounds weight of fat so prepared, together with forty pounds of fresh bees' wax, to the oil above mentioned, and mix and melt them together, keeping them at a temperature of about 150 degrees of heat of Fahrenheit until they are thoroughly incorporated. *Fourthly*, I take of gum caoutchouc two pounds and a half, sliced in small pieces, and dissolve it in fifteen pints of rectified oil of turpentine, by exposure to a heat of 250 degrees of heat of Fahrenheit by means of a sand bath; and, *Fifthly*, I take twelve pounds and a half of Burgundy pitch, and dissolve it in twenty pints of rectified oil of turpentine, by exposure to the temperature of 200 degrees of heat of Fahrenheit by means of a sand bath. I allow these mixtures of caoutchouc and pitch respectively to cool to a temperature of 150 degrees of heat of Fahrenheit, and then I add both of them to the oil, fat,.and bees' wax, as previously prepared, and stir up the whole composition until it is cold.

Composition No. 2.—I take *First*, oil, fat, and bees' wax melted and combined together, as before described, at a temperature of 150 degrees of heat of Fahrenheit. *Secondly*, I take ten quarts of oil of turpentine, and dissolve in it fifteen pounds of yellow resin, by means of a sand bath, at a temperature of 200 degrees of heat of Fahrenheit; and, *Thirdly*, when the mixture thus prepared of resin and oil of turpentine is cooled to the temperature of 150 degrees of heat of Fahrenheit, I add the resinous combination to the oil, fat, and bees' wax, and then stir up the whole together until it is cold.

Composition No. 3.—I take of purified cod-oil, or highly purified spermaceti whale-oil, twenty gallons, of gum-caoutchouc in its natural state, sliced in small pieces, from fifteen to twenty pounds. I subject these, when put together, to a temperature of from 200 to 250 degrees of heat of Fahrenheit, or to a sufficient heat completely to effect the solution of the gum-caoutchouc in the oil.

Composition No. 4.—I take a sufficient quantity of rectified oil of turpentine to submerge fifteen to twenty pounds (according to its quality) of gum-caoutchouc, sliced in small pieces; I cause it to simmer by means of a sand bath, or heat of 250 degrees of heat of Fahrenheit, until the gum-caoutchouc be thoroughly dissolved. I then add to this composition twenty gallons of purified cod-oil, or highly purified spermaceti whale-oil, (either of the latter being at the temperature of 200 degrees of heat of Farenheit,) which temperature I continue until the whole of the mixture forms a fluid smooth mass. I then allow the temperature to subside to 150 degrees

of heat of Fahrenheit, and I then add to the mass ten pounds of fresh bees' wax, and stir up the whole until it is cold.

Having described my compositions, I now proceed to shew the manner of their application. I divide leather into two kinds, according to the thickness and weight of the material, as leather hides and leather skins, and I use the compositions No. 1 and No. 2 with leather hides; and No. 3 and No. 4 with leather skins; for leather, whether from skins or hides, after the process of tanning, is still porous, and in a very short time admits water. By the following combination of my compositions, herein before described, with leather skins or leather hides, I render the leather impervious to wet, more flexible, and more durable.

As to the process for leather hides: I effect their saturation with the composition No. 1 or No. 2, by placing them in layers, or upright, side by side, in a tank or suitable vessel, which vessel communicates with a boiler or melter, in which the composition No. 1 or No. 2 is prepared; the composition being heated to a temperature of from 100 to 120 degrees of heat of Fahrenheit, is then let in upon them, or suffered to flow in upon and amongst them, until they are wholly submerged, and in this submerged state they remain from two to three hours, when they will be found fully saturated with the composition. They are afterwards taken out, and exposed to a current of the atmospheric air, at a medium temperature, until thoroughly dried. I apply hydraulic pressure in this process in vessels and apparatus properly suited to such hydraulic pressure in the ordinary way, or by placing the leather hides in an air-tight vessel, which is then exhausted, or partially exhausted, of its contained atmospheric air; and in that state of vacuum, or partial vacuum, and in this state of the leather hides, I admit the composition which it may be determined to apply to such leather hide, upon the principle above stated, such composition being previously heated to a temperature of 100 to 120 degrees of heat of Fahrenheit, the composition in this state being by the pressure of the external atmosphere driven into the vessel containing the leather hide or hides, and saturating them completely, whenever the intractability or peculiar nature of the hides to be operated upon is found to require more pressure or more effective treatment than is afforded by simple submersion. I use the composition No. 1, when the leather hide has been tanned with oak-bark, and No. 2, when it has been otherwise imperfectly tanned. *Secondly*, as to leather skins: I effect my improvements by making a complete saturation of the entire substance of the leather skin with the compositions No. 3 and No. 4, herein before described; and I use the composition No. 3, when the leather skin is very thin, and the composition No. 4, when it is rather thick; and this I perform in practice, by placing the leather skins upon metallic plates, heated to 100 degrees of heat of Fahrenheit, and more or less saturating them,

according to the purposes to which such leather skins are to be applied, with one of the compositions, No. 3 or 4, heated to the same degree of heat, viz., 100 degrees of heat of Fahrenheit, for which purpose I use large stiff brushes dipped in the composition, and rubbed over such leather skins. I also perform the process of saturation as described by rarefaction of the atmospheric air, contained in a room constructed for the purpose, in which manufactured articles formed of leather hides or leather skins may also be subjected to this action of heated or rarefied atmospheric air; and although the process does not afford the same degree of saturation as can be obtained under the before-mentioned process for the saturation of unmanufactured articles, they will yet acquire thereby an improved degree of flexibility, become impervious to moisture, and possess a character of greater durability than when in their unprepared state.

I conduct and perform the process with, or on, manufactured goods, as above-mentioned, by exposing such goods in a temperated apartment, at a temperature of from 100 to 120 degrees of heat of Fahrenheit; and the articles having been thus exposed during from one to two hours, and having so become thoroughly warmed, they are then to be payed over with one of the compositions hereinbefore described, until they are saturated therewith; they are then returned to the temperated room, and subjected to the same temperature until they are dried, which will in general be effected in the space of from half an hour to an hour.

I now declare, that I claim, as part of my invention of certain improvements in rendering leather skins or leather hides impervious to wet, more flexible, and more durable, the four compositions, prepared and compounded as I have hereinbefore described them: and I also claim, as other part of my said invention, the combination and the applications of those compositions to leather skins and leather hides, as above described; and those two parts taken together form the combination of my materials and leather, which is my invention, and by which I make leather skins or hides impervious to wet, more flexible, and more durable, when used.

In witness whereof, &c.

Enrolled July 11, 1844. WILLIAM WRIGHT.

Specification of the Patent granted to WILLIAM FLETCHER, *of Moreton House, in the county of Buckingham, Clerk, for " certain Improvements in the Construction of Locks and Latches, applicable to doors, and other purposes,"* Sealed, Jan. 30, 1844. WITH ENGRAVINGS.

THE lock of security, made under its various modifications for doors and other openings, is generally and well known, but

in directing attention to a new device for such an instrument, it is necessary to make a brief analysis of the general construction, in order to understand the peculiar character of the new invention. The common lock consists simply of a strong bolt, which is fitted in a proper bed or case affixed to the door. Much art and delicacy are required in forming and varying the minor moving pieces and arrangements of locks, and in adjusting them properly to the places where they are to be used, as well as in varying the forms and the combinations of their component parts, so as to accommodate them properly to the occasions and situations in which they are to be employed.

The first or general principle of construction on which all locks depend, is the application of a lever to an interior bolt, by means of a mechanical communication from without, so that by means of the latter the lever acts upon the bolt, and moves it into a staple or other recess, by which the door or lid of the opening is secured from being opened till the bolt is returned to its original situation, by the same means as those by which it was first moved forwards. The security of locks, therefore, evidently depends on the number, or the peculiar form, or the combination, of the impediments which can be interposed between the lever, or key, and the bolt which secures the door; these impediments are termed wards, and consist of short projecting pieces of iron, with corresponding notches formed in the key, to allow it to pass over them, and so penetrate beyond them. It will be equally evident that it is the number and intricacy, or the peculiar form and combination of these, which constitute or distinguish what is termed a good lock from a bad one. If the wards do not, however, cover each other so as effectually to preclude the access of all other instruments besides the proper key, an object very difficult to effect, it is still possible for a mechanic of equal skill with the fabricator of the lock, to open it without the key, and thus to render the door and lock insecure; and hence have originated a great number of ingenious constructions of locks, in which this general objection to the common lock is in a greater or less degree avoided.

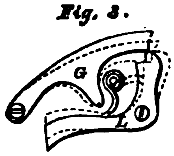
In the determination of the principles which are to govern a mechanical construction to effect a given purpose, there are two distinct courses to pursue, each of which may, under the guidance of skill and a correct judgment, conduce to the required successful result; either an ingenious formation and arrangement of parts, with suitable combinations, to compose a compound instrument of such complication and intricacy that a successful invasion of the lock shall be impracticable to any but persons possessing equal skill, and therefore so far practically secure; or, by adopting a simplicity of construction, which requiring but few parts, will allow greater strength to their forms, and within the ordinary bulk of the instrument, to apply secondary parts, as checks to the action of the bolt, which shall thus be impracticable without actual fracture. Of the latter

description are the constructions forming the subject matter of the present invention. Its simplicity brings it within the denomination of the construction last described, and gives it a compound character of universality and security hitherto considered unattainable.

To all whom these presents shall come, &c., &c.—I declare the said Invention to consist in the principles of construction, and the modes of arrangement of the mechanical parts, and the several combinations thereof as hereinafter described, as regards my application of the same to the object set forth in and by the title of the letters patent granted to me as hereinbefore recited.

The particular nature and intention of my said invention is the formation of locks and latches of security for doors, openings, and all constructions and arrangements usually requiring such modes of secure fastening; such locks and latches being of more simple arrangement and construction, and more efficient in their action, than locks and latches have hitherto been made. And I declare that the following specification, taken together with its accompanying drawings, which form part of, and belong to, the said specification, does truly describe and set forth the modes of arrangement and construction which I prefer and adopt, and in practice find best suited to effect the required end.

Fig. 3.



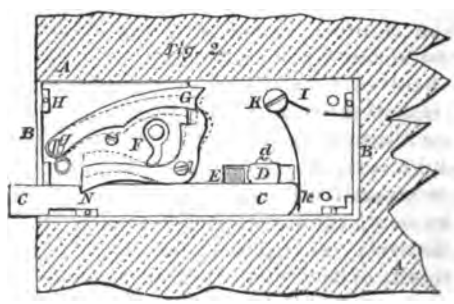


Fig. 1.

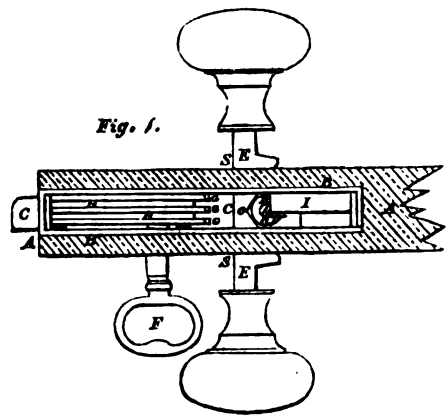


Fig. 4.

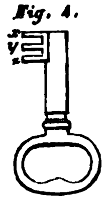


Fig. 5.



Description of the drawings.—Figure 1, represents a top edge view of a lock, in which A A is a portion of the door or wood work in which it is set, and B B the metal box of the lock. C C is the bolt, and D a metal roller set thereon, or attached to it by a centre pin *d*, on which it is at liberty to revolve freely. E E is an indented bar, presenting by its indentation *e* two short inclined plane edges, which, acting upon and against the roller D, when the bar E is pressed either forward or backward, press the bolt C, to which the roller is attached, into or out of the staple or recess in which it is intended to be shot. This action of the bar E E upon the bolt, can however only be produced by previously releasing the bolt from its retention by the moveable levers formed, arranged, and set for that purpose. Three of these levers are shewn in an edge view at G G G, and they are divided or separated from each other, and kept in clear and distinct action by the separating plates H H. These moveable levers are governed in their action on the bolt C C, through the agency of the key F.

The figure 2 shews a profile or side view of the lock, with one of its side plates taken off to expose its construction and parts; the same parts are marked respectively with the same letters of reference as in the figure 1. B B is the box of the lock, C C the bolt, D the roller, E a portion of the lever acting on the roller, F the key-hole, G one of the moveable levers shewn in the figure 1, H one of the separating plates, and I a double armed spring fixed in the box on a pin K, and acting against the heel of the bolt at *k*, to hold the bolt in steady motion. L is one of three other levers, set immediately under the three upper levers G G G, shewn in figure 1. The action of these compound levers, as regards their effects on the bolt C C is thus. The lower levers L are each hung on a centre pin *l*, and the upper levers G are each hung on a centre pin *g*; and they are each respectively moveable on those centres by the action of the extremity of each of the bars or arms of the key, marked *x y z* in the separate view of the key at figure 4; the arms of the key acting on the inner curved edges of the levers respectively, and such arms may, for additional security, be made of different lengths; the bolt C C has a deep notch N, seen in figure 2, into which the heel of the lower lever L will engage, when by the action of the key its upper extremity is released from the holding back of the upper lever G. When the levers L are engaged in the notch of the bolt, the bar E E has no room of action or power on the bolt, but when the bolt is released from the levers L, the bar E E will act upon the bolt as described. In this figure the dotted lines shew the second action of the levers. The figure 3 is a modification of these levers by giving them edges of different curvature, and assigning to the action of the key a more confined range. If the key be made with a slot, as shewn at C, the centre pin O will be connected with the wards at

C, and then the key will only move so much either way as to enable the levers to confine or release the bolt. In this figure also the dotted lines shew the second action of the levers. The figure 5 shews an end view of the key, seen in profile in figure 4.

The figures 1 and 2 represent the combination of both lock and latch in one; the action may be produced as described, by the direct motion of the bar E, when it is deeply indented as shewn at *d*, in figure 2, or such indentation may be of any assigned form or quantity of depth at pleasure; the principle of its construction and action remaining unchanged by any such variations. The projection or shooting action of the bolt may also be produced by the agency of the bar E, if it be formed without any such indentation as that described. If the bar be made without indentation, then its action on the bolt will be as a lever acting obliquely and transversely, either backwards or forwards, using the fixed points of the box at s s as fulcra in the operation, which will be, either by the operator drawing the outer extremity of the lever towards him, or, on the contrary, thrusting it from him. Its action, in this mode of using and applying it, thus becomes universal in the same plane. The combination of the levers G and L, as above described, is effected in the same way as in the case of an indented bar.

Fig. 9.

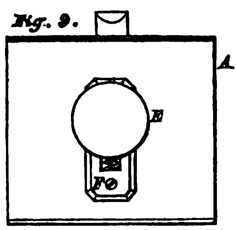


Fig. 7.

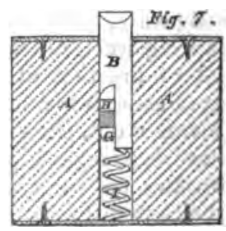


Fig. 8.

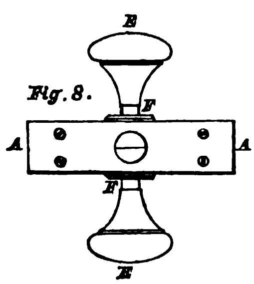


Fig. 6.

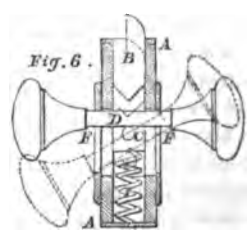
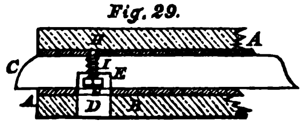


Fig. 29.



The figures 6 and 7 represent sections of a bolt-latch of simple and effective construction.: A A is the box of the bolt-latch, B the bolt, in which there is fixed a projecting stud C, near its heel or inner extremity. A straight lever D, passes transversely through the structure, as shewn in the figure 6, in close contact with the stud C, terminating on its inner and outer extremities in handles E E. F F are face plates fixed on the door, having each a longitudinal slot of sufficient length to allow an oblique traversing motion to be performed by the lever D through their length, either by pulling the handle towards the operator, or pressing it from him, as before described in figures 1 and 2. The bolt B is acted upon by this oblique traversing motion of D, by the stud C. I is a helical spring, set immediately behind the heel of the bolt B, to produce a steady and uniform action. The dotted lines of this figure shew the range of action of the traversing motion of D. The figure 7 shews the figure 6 in profile or side view, the same parts being in each figure respectively marked with the same letter of reference. The figure 8 is an exterior edge view of the same, the same letters of reference being used to the same parts respectively. Figure 9 is an exterior view of the outer face of the same. The bolt B and its spring I, may also be inserted in a cavity formed for their reception in the woodwork of the door, making slots on the sides for the admission and action of the bar D. The figure 10 represents a profile or side view of a latch of simple and effective construction, on the same principles; the simplicity of its construction and action effecting economy of cost and an equable and silent operation; A A is the outer face of the latch, and B B the box, C is the bolt, and D D a lever bar acting upon a projecting stud, fixed in or on the bolt, using the ends of a longitudinal slot as fulcra; E E are the terminating handles for operation. Figure 11 shews the inner face or side of the latch, having its cover removed in order to shew its arrangement and combination. A A A A is the outer face, and B B the box; C C is the bolt, and D the lever bar acting upon the stud E. Figure 12 shews the same view of the latch, having the cover G replaced. The figure 13 shews the latch complete in an exterior view, the same parts being respectively marked with the same letters of reference. The figures 15 and 16 are respectively top views and profile views of the bolt C C with its stud E.

The figure 14 shews an end view of the latch. The figure 17 shews a view of the inner face of a latch of yet more simple and economical construction than the latch last above described, having its acting lever and the handle thereof of single action, and on one side only. A A is the outer face, and C the bolt; E is the handle of the lever bar, and F a face plate, in which there is cut a longitudinal slot G, in which the opening action of the lever bar takes place. Figure 18 shews a view of the

inner face, with its cover removed to shew the internal arrangement: C is the bolt, D the lever bar, and E the stud of the bolt; I is the helical spring, as in the construction shewn in figure 10.

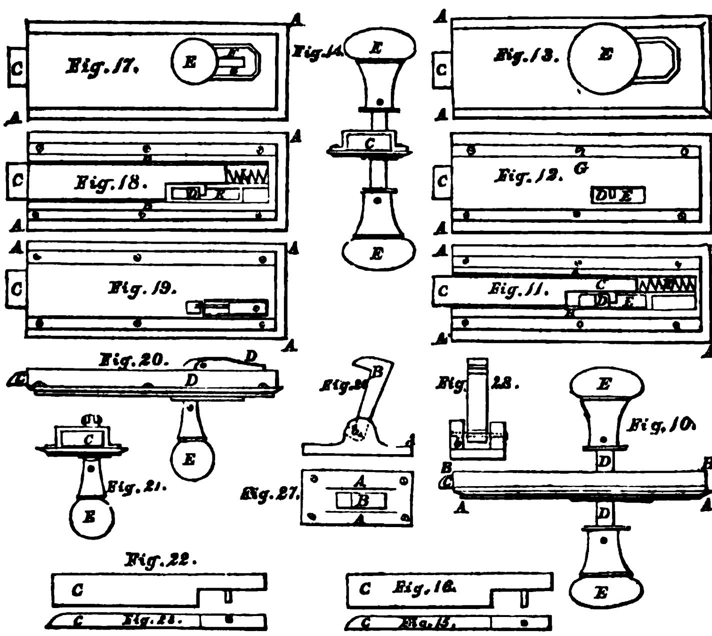


Figure 19 shews the inner face, having the outer cover replaced. Figure 20 shews a profile view of the latch, in which the single action of the lever bar D, and its terminating handle is seen at D D and E. Figure 21 shews an end view of the same, the same parts being in the figures 17, 18, 19, 20, and 21, respectively marked with the same letters of reference. Figures 22 and 23 are respectively profile and top views of the bolt C.

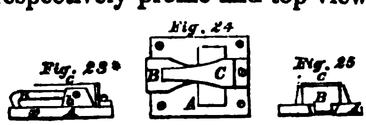


Figure 23* is a side elevation of a securing hook or catch to be applied to the jamb of a door to which a lock is affixed, for the purpose of receiving and securing the toe of the bolt when it is shot into its staple or recess. A A is its foundation plate, by which it is to be attached to the door jamb; B the hook moving on a centre pin *b*; C is a flat spring fixed by one extremity to the plate A, and by its other extremity receiving the rise of the hook B, and returning it to its action upon the toe of the bolt. Figure 24 is a plan view of the same, and figure 25 an end view. The same parts in each of these figures 23, 24,

and 25, are respectively marked with the same letters of reference. By the introduction of a small roller, at the toe x of this hook, its action on the bolt will be rendered more smooth and equable. Figure 26 shows a more simple modification of a securing hook for the same purpose, in which A is the plate by which it is attached to the door jamb; and B the hook moving in a pin joint at *b*. Figure 27 shews a plan view, and figure 28 a back profile view of the same. Figure 29 shews a differently modified method of securing the bolt of a lock or latch, after it is shot into its staple or recess by any of the above described constructions; and affording also the means of an internal fastening for the bolt, when such is required. A is the box of a lock fixed in a door B, and C its bolt; D is a hole cut through the wood-work and outer face of the box of the lock, and E a corresponding notch or recess cut in the bolt C; when the bolt, by being shot into its staple, has the recess E brought opposite to the hole D, a male screw F working in a female screw cut within the bolt, is made to enter by its toe at H, into the opposite side of the box of the lock; this is effected by turning the screw F the amount or distance of one of its threads forward, by the application of a key to its head at D.

I now declare that I claim as of my invention, the combinations and arrangements of mechanical parts, and the organizations of the same, to carry into practical effect, the principles of construction on which such combinations and arrangements, and such organizations are made, as the same are herein set forth and described; and that, when formed and constructed of any suitable material whatsoever, as applied to the objects and intentions of my hereinbefore recited patent.

In witness whereof, &c.

WILLIAM FLETCHER.

Specification drawn by Mr. Alexander Prince.

REGISTRATION OF DESIGNS FOR ARTICLES OF UTILITY.

Under the Act 6 & 7 Vict. cap. 65.

A new Tilt Hammer. By Messrs. JOHN VERNON AND CO., of the Dee Iron Works, Aberdeen, N. B.

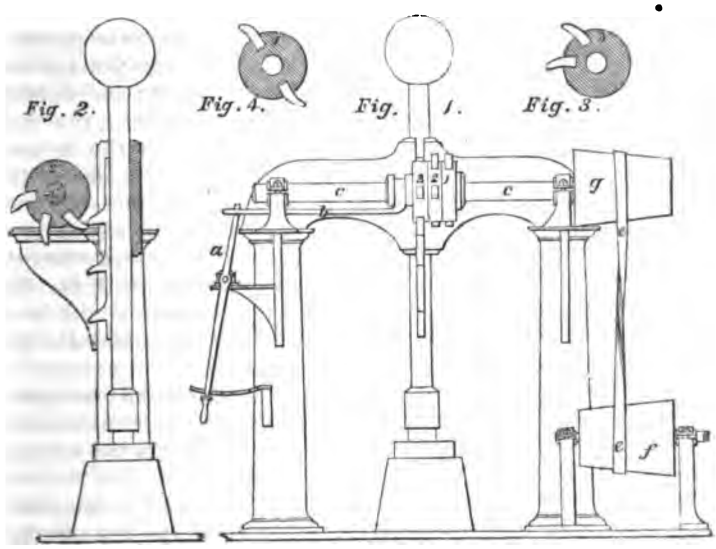
THIS is a very ingenious and useful construction of a tilt hammer, for the usual purposes of that engine in its application to the lighter operations of iron-working. The principle of its construction is the making its arrangement and combination such as admit of its power and its rapidity of action being changed or varied, at the will of the operator, to suit the requirements of the work to be done.

The old construction of the tilt hammer is a lever or shaft, carrying at one extremity the hammer, and being suspended at about one-third of the length of its shaft from the opposite extremity, on trunnions or axles cast upon it, working in brass bearings. The end of the lever on which the hammer is placed, is elevated by depressing the opposite end of the lever; and this is effected by a wheel acting upon that opposite end which extends beyond the point of support. The wheel is of cast iron, and is formed with cambs or tappets, which, during the revolutions of the wheel, engage on the end of the shaft, and continue to depress it, until by the continuation of the motion it is disengaged, and the hammer-head falls upon the anvil with the momentum due to its weight and the height of its fall. By the continued revolution of the wheel, the operation is continuous, and the hammer strikes on the anvil at regular intervals.

The principle of construction of the new invention differs materially from this. The stroke or blow of the former construction is made in the arc of a circle, the centre of motion being the axis of the trunnions of support. In this the shaft of the hammer stands perpendicularly to the face of the anvil, and the blow is made in the vertical direction of the axis of the shaft. The construction by which this action is produced is as follows:—On the shaft of the hammer there are fixed projecting tappets, and these are acted upon by the teeth of a camb-wheel moving on a spindle, set at a small distance in front of the shaft of the hammer. The hammer shaft has free vertical motion in an iron supporting frame. The spindle which carries the camb-wheel is driven rapidly and regularly by bands or straps connected with the first mover. In the case of this invention, the speed of the spindle, the revolution of the camb-wheel, and of consequence the rate at which the strokes of the hammer are made, are required to be variable at the will of the operator, and therefore the velocity of motion of the spindle is changed by the adoption of the system of alternate cones, as represented in the figure. The rate of succession of the blows of the hammer is regulated by having camb-wheels of different formation, either of which can be thrown into action with the hammer-shaft at pleasure. The figure 1 shews an iron frame supporting a vertical hammer-shaft. *c c*, a spindle carrying the camb-wheels 1, 2, and 3, which act upon the tappets of the hammer-shaft, lifting it when they engage with them, and allowing it to fall when they disengage. The lever *a* moves a clutch *b*, by which the cambs are pressed into their places of action. *e e* is the driving-strap by which motion is given to the spindle *c c*, and *g g* the alternate cones for changing the velocity.

Figure 2, is a profile or side view of the machine; and the figures 3 and 4, are camb-wheels of different formation. The hammer-shaft receives the additional weight necessary to

increase the momentum of the blow, by loading its upper extremity, as it is shewn in the figure, by the moveable iron ball.



Registration drawn by Mr. Alexander Prince,
14, Lincoln's Inn Fields.

Dr. Potts's *Patent for Improving the Construction of Piers, Embankments, Breakwaters, &c.*

Dr. Ryan has delivered at the Royal Polytechnic Institution, to a select circle of scientific men, an instructive lecture upon Dr. Potts's patent for improving the construction of piers, embankments, breakwaters, and similar structures. He pointed out that this invention is directed to the formation of submarine foundations, though applicable to the construction of bridges, docks, and railroads, in situations where the soil is loose, or upon the borders of water.

The main feature of Dr. Potts's process is the substituting of pneumatic power for manual labour. He uses hollow iron tubes as his piles. The lower extremity of the pile is open, and it is placed in a vertical position upon the bank or other ground, whether composed of sand, mud, or other substance, miscible with or diffusible in water. To the upper extremity of the tube or pile, is affixed an air-tight cap, with a flexible tube of jointed metal, or elastic hose, extending to a close receiver, from which the air is extracted by air pumps, the condensation of steam, or any of the modes which are effectual in producing that action which we call suction; being in fact the

removal of the pressure of the atmosphere, or the formation of a vacuum.

When the air within the receiver, the connecting flexible tube, and the hollow pile, becomes sufficiently attenuated, a mixed body of sand, or mud and water flows up through the hollow pile and connecting tube into the receiver; and as often as the latter is filled with the mixed body so raised, the contents are discharged through a cock or valve at the bottom. As the sand or mud thus rises in the pile, the pressure of the atmosphere being removed from its interior, the pile descends by its own weight, and the external pressure of the atmosphere. The rapidity of the descent of the pile, will necessarily be proportioned to the degree of exhausting power applied, and the supply of water from beneath. The pile descends with astonishing rapidity in loose materials, such as sand and shingle, and provision is made in the arrangement of the apparatus, for disturbing and bringing under its operation, materials of greater tenacity—and supplying the water to serve for their temporary suspension in the current. The importance of the time gained in extensive works is obvious.

A succession of tubes may be added to the first by means of screw, internal socket, flange, or other joint, as the circumstances of the case may require.

The shape of the tube may be cylindrical, angular, or conical, according to the nature of the work, and may be provided with external edges or wings, so as to fit each other, and form a continuous line or wall of piles.

In works where an insular or detached erection may be required, as in the commencement of a breakwater, at a depth of six or seven fathoms in the sea; or for the foundation of a lighthouse, tubes of very large diameter may be used, or a series of them may be fitted to form, as it were, staves to unite in the construction of a tube or ring of vast dimensions confined together by hoops and bolts, gradually put together in the water. By an ingenious contrivance, the tubes may be floated to the spot where the insular rock is required, where they can immediately be put to work to secure a firm foundation in sand, mud, shingle, or chalk.

Again, in Dr. Potts's plan are included arrangements for filling the interior of the piles with stone or shingle, cemented into a compact or solid form; also, for the introduction amongst, between, and round the bases of the piles, of certain solutions, pastes or cements, calculated to combine with, and solidify the sand or such other soil or materials, as they may be sunk into. This is to be done by an hydraulic pump so arranged as to distribute the cement through the lower aperture of the tubes, so as to unite them and the soil surrounding and supporting them into one mass. Provision is also made for the formation of artificial rock; from the materials abounding in

the situation where such rock may be required in the construction of breakwaters, sea batteries, and the like. Thus chalk, shingle, and sand may be united by cheap cement, applied dry, so as to form the whole into a solid rock, between two tubular walls, penetrating the bed of the sea, and held together by wrought iron ties and braces.

SCIENTIFIC MEMORANDA.

I.—THE ROOK.—CORVUS FRUGILEGUS.

In some districts of Ireland the rooks suffer severely during the interval between the sowing of the spring crops and the autumn, a season in which ploughing operations in a great measure cease, so that the supply of larvæ, &c., no longer affords them subsistence. If the season should also prove dry at the same time, their sufferings are still more intense. During this period, the famishing birds may be seen in the maritime districts skulking into corners in search of food, or greedily rooting up the grubs which are sometimes found in the heaps of sea-weed which have been collected for manure. They also spread themselves along the shores in quest of the small marine insects which lie scattered about, or if severely pressed by hunger, they pick up any stray offal that may fall in their way. Sometimes they exercise the same instinct as the gulls and the gray-crows: when they meet with a molluscous animal, and which is not easily removed from its testaceous covering, the rook will then rise in the air until it attains a sufficient altitude for its purpose; it then lets its captive fall to the ground; the shock of striking on a hard surface is generally sufficient to fracture the shell, or to force the animal in part from its calcareous citadel, when it becomes an easy prey to the bird. Whilst the shell is falling, the bird descends rapidly after it, lest some intrusive beak might bear the expected prize away. This instinct is paralleled by the blackbirds and thrushes, who carry the snails they feed upon to some stone suited to the purpose, against which they continue to strike the shell, still retaining it partly in the beak, until it is sufficiently broken to enable the bird to seize on the contents. In plantations and other favourite haunts of these birds, piles of snail-shells so broken may always be seen along side-stones selected for the crushing process. The strange fancies the rooks sometimes indulge in, when founding a new colony, afford amusing instances of what to a mere spectator would appear whimsicalities, but which no doubt the birds have good and sufficient reasons for observing.

In the spring of 1840, a number of rooks commenced building their nests in the low trees which ornament the approach to Mr. Allen's house at Ballystraw, near Duncannon, county of Wexford. After the labours of the day were over, they would

assemble in the trees, and apparently take up their station for the night; but no sooner did the twilight fade away than the rooks, as if distrustful of their safety, took flight to Kilmannock, the seat of Mr. Haughton, near Dunbrody Abbey. In this manner they continued nightly to forsake the newly planned colony until incubation commenced, when they were constrained to remain, or to spoil their eggs by leaving them. They preferred the former and reared a numerous progeny. According to our notions of such matters, the trees here alluded to were, from their small size, totally unfit for the purpose to which the rooks had applied them; but they no doubt were led to select the spot from its proximity to good feeding ground, or other cogent considerations. It is a remarkable fact, that the rooks which build in the trees at Woodstown, the seat of Lord Carew, on the Waterford side of Waterford Haven, always obtain their supplies of food for their young ones from the Wexford side. The distance they have to fly across the estuary little less than two miles, yet do they invariably undertake the journey many times a day, even in the most tempestuous weather, and when it is difficult to make head-way against the storm [a].

II.—SALMON BREEDING.

Considerable interest has lately been excited on the subject of breeding salmon in our rivers, and in artificial waters. An ingenious inventor of one of the fashionable lamps of the day, claimed to be the first observer of the means by which this was to be effected. Dr. Buckland, at the last meeting of the Ashmolean Society, read a portion of a correspondence between Sir Francis Mackenzie and Professor Agassiz, which had been made public in Scotland in the year 1840. This contains the Professor's directions for breeding fish, and from which it would appear that artificial salmon breeding can be carried on with greater ease, and at far less expense, than we now breed pheasants. Although the instructions were intended solely for the private use of Sir Francis Mackenzie, Professor Agassiz has permitted their publication. The following is a translation of his statement.

To artificially make the eggs of fish productive, it is, above all, important to assure oneself if the parent fish, upon which one would operate, are in a proper state. As soon as the females let go their eggs at the least pressure upon the stomach, and that the males let their milt flow abundantly, they are fit for reproduction. The most simple means of making the eggs fruitful, is to squeeze the ova or roe in a basin of fresh water, at the ordinary temperature of the water which the fish inhabits; then to squeeze in the same vase the milt of the male, and to

[a] Annals and Mag. of Nat. Hist., No. 82, p. 92.

mix them with a spoon as soup or porridge; then let them remain still about half an hour, and afterwards place them in the water where they are to develope themselves. It is necessary to put them often in movement to stop mouldiness and decomposition, which is easily done by placing the eggs in baskets or sieves, which are shaken from time to time like corn sieves. The spoiled eggs always causing disease, one can take them away, and thus hinder any contagion. The time necessary for hatching varies accordingly to the sorts; but when the little ones are hatched, they must not be disturbed for some days. Their best food consists of pounded fish roe, or the lungs and intestines or fæces of sheep squeezed out of the gut. The eggs of fish which spawn in the rivers ought to be placed in a running water, those of a lake in some basin, provided that the water is renewed. It is especially of consequence that the temperature of the water does not rise above that of the waters which the fish (which one wishes to bring up) inhabits generally. One can be certain that the eggs are in a good condition, so long as they do not turn opaque, or of a whitish hue. Thus, 1st. Be assured that the impregnation be complete, in suitably mixing the eggs and the milt; 2nd. Keep the eggs in almost a continual motion; 3rd. Keep the water in a suitable temperature; 4th. Not disturbing the little ones during the first days of their existence; 5th. Afterwards furnishing them with a sufficient nourishment,—are the essential conditions of developing the eggs which are to be fructified artificially. The sieves which I use are of coarse cloth, or if iron wire, plaited and stretched upon a frame, in the shape of the box where the water is put, keeping always a continual current. But I would recommend wicker baskets, as, perhaps, softer and preferable. After the impregnation, one can transport the eggs to great distances, provided the water does not heat. The eggs of fish of the salmon tribe can survive the freezing of water which shuts them up, but not those of fish which spawn in spring. One egg of sea trout, of the salmon tribe, has passed, during fifty-four days, regularly five or eight hours a day, under the microscope, in some drops of water, and the fish hatched regularly, which proves that they are not delicate in rearing.

III.—DESTRUCTION OF RATS.

The following communication has been made by Dr. Ure, F.R.S., through Mr. Pusey, M.P., on the mode of preparing an effective poison. In the Journal of the Royal Agricultural Society, there was published, several months ago, a prescription for preparing a poison for the destruction of vermin, by an English gentleman, residing in Germany. That preparation consisted essentially of phosphorus mixed with flour and sugar. It has been tried by a friend of mine in Derbyshire, who has a most extensive farm, and found to answer the purpose well;

but there is a great difficulty in preparing it, from the insolubility, and even immiscibility of phosphorus in water, attended with no little danger of fire. The process I have found to succeed perfectly is as follows. Melt hog's-lard in a bottle plunged in water heated to about 150° Fahr.; introduce into it half an ounce of phosphorus for every pound of lard; then add a pint of proof spirit, or whiskey; cork the bottle firmly after its contents have been heated to 150°, taking it at the same time out of the water bath, and agitate smartly till the phosphorus becomes uniformly diffused, forming a milky-looking liquid. This mixture, being cooled with occasional agitation at first, will afford a white compound of phosphorus and lard, from which the spirit spontaneously separates, and may be poured off to be used again, for none of it enters into the combination, but it merely serves to comminute the phosphorus, and to diffuse it in very fine particles through the lard. This fatty compound, on being warmed very gently, may be poured out into a mixture of wheat flour, and sugar incorporated therewith, and then flavoured with oil of rhodium, or not, at pleasure. The flavour may be varied with oil of aniseed, &c. This dough being made into pellets, is to be laid in rat-holes. By its luminousness in the dark, it attracts their notice, and being agreeable to their palates and noses, it is readily eaten, and proves certainly fatal. They soon are seen issuing from their lurking places to seek for water to quench their burning thirst; and they commonly die near the water. They continue to eat it as long as it is offered to them, without being deterred by the fate of their fellows, as is known to be the case with arsenical doses. My friend in Derbyshire bought a pot of Mr. Mayer's rat poison, and found it to be an analogous phosphoric preparation. The present mode of preparing it is the result of my own experiment, made with the view of diffusing phosphorus through a mass of flour and sugar, &c., without the risk of fire.

CONDUCTING POWER OF THE EARTH FOR THE ELECTRIC CURRENT.—The following is an abstract of the very beautiful and important series of experiments recently laid before the Academy of Sciences, by M. Matteucci, as a subject of great moment in connexion with the electric telegraph. Mr. Bain and Professor Jacobi had previously shewn that the earth was capable of conducting an electric current almost without resistance, and hence that one of the wires of the circuit might be dispensed with. M. Matteucci was induced to repeat these experiments, and also those of Professor Wheatstone, in order to determine the point with greater accuracy. He made use of 14,000 feet of copper wire, No. 8, supported four feet above the ground, on pieces of dry wood, and he employed Nobili's galvanometer to measure the current which proceeded from a single Bunsen's element, consisting of carbon and amalgamated zinc excited by rain-water. Having first determined the amount of resistance

opposed by different lengths of the wire to the passage of the current, he proceeded to compare with these, the resistance afforded by different lengths of earth. Two wells were chosen, which were 56 feet distant the one from the other, and into each was plunged a plate of iron, about three square yards in surface, and connected with the copper wire. By inserting the pile and the galvanometer in the circuit, it was found that the resistance afforded by 56 feet of earth to the passage of the current, was equal to that presented by 1618 feet of the wire. Two other wells, 720 feet apart, were next employed. In the former experiment, the circuit consisted of 720 feet of wire, and 56 feet of earth; in this second one it consisted of the same, 720 feet of wire, but there were 720 feet of earth instead of 56, and, nevertheless, the current was exactly the same in both experiments, shewing that no more resistance was offered to the current by the longer than by the shorter distance of earth in the circuit.

In the third experiment, the circuit consisted of 1560 feet of wire, completed by the earth, between two wells 1036 feet from each other in a straight line. The pile gave a constant current of 26°.

In the experiment already mentioned, where the circuit consisted of 720 feet of wire and 720 feet of earth, the current was 17°.5, and when the circuit was lengthened by substituting 2240 feet of wire for the 720 feet of wire, the current transmitted was 16°.7. M. Matteucci states that it results from these experiments that a layer of earth, of greater or less thickness, presents the same resistance, and that the resistance first presents itself on the introduction of the current into the earth, and that, moreover, this resistance of the earth disappears in experimenting with great distances.

The next experiments were tried on a larger scale, and afforded results of the most unexpected kind, and such as admit of no explanation. Two wells were chosen, distant from each other 9770 feet, and an equal length of wire completed the circuit; but before using the earth the current was transmitted through the 9770 feet of wire *alone*, and was found to give a constant deflection in the galvanometer of 6°.5. The circuit was now completed by plunging the iron plates at each extremity of the wire into the wells, so that there were 9770 feet of wire, and the same thickness of earth, for the current to traverse, and, nevertheless, the galvanometer indicated a constant current of 8°. The additional current was proved by experiment not to have proceeded from the action of the water in the wells upon the plates.

M. Matteucci next sought an explanation of this anomalous circumstance from the influence of the electricity of the earth, but the result was precisely the same, notwithstanding the satisfactory means made use of to obviate the errors which might arise from that cause. The results were similar when the experiments were repeated on a soil of a different chemical and

mechanical constitution, and it hence appears to follow as a somewhat paradoxical conclusion, that for great distances it is actually easier to transmit an electric current through a circuit consisting of one length of wire, and an equal length of earth, than it is to transmit the same current through a circuit composed of the one length of wire alone.

In the construction of the electric telegraph, therefore, it will be, in M. Matteucci's opinion, a decided advantage to dispense with one of the wires, making use of the earth instead, to complete the circuit.

VENTILATION AND WARMING BUILDINGS BY HOT WATER.—Mr. Hood has given us a useful work upon these important works, to which we trust we shall have future opportunities of directing attention. It is a republication of an edition which proved successful with the incorporation of several papers which have been read before the Institution of Civil Engineers, and the articles on Stoves and Ventilation, which were furnished by Mr. Hood for the Encyclopædia Metropolitana. He shows an intimate acquaintance with a most important branch of practical knowledge, and has collected together a vast mass of facts which he has carefully digested and clearly explained. The chapter which treats on stoves, gives a very copious view of the various means which were employed at an early period for warming buildings, and has brought down to the present period a history of inventions and improvements.

ANTIDOTE TO PRUSSIC ACID.—Messrs. Smith, of Duke Street, Edinburgh, have undertaken the task of rendering prussic acid inert as a poison by neutralizing it, by combining it with iron, partly in a state of peroxide, partly in that of protoxide, so that a prussiate of iron would be formed. Until some experiments upon living animals demonstrate the fact, this can only be considered a chemical theory of considerable ingenuity.

REVIEWS.

Commerce of the Prairies; or, the Journal of a Santa Fè Trader, during Eight Expeditions across the Great Western Prairies. By JOSIAH GREGG. New York: H. G. Langley. London: Wiley and Putnam.

THE commerce of the Prairies, carried on as it is by caravans of hardy traders, who, with a large amount of waggons and with a considerable escort, advance across the vast plains and deserts, and ford the numerous rivers which separate the United States from New Mexico, is of itself a wild and exciting feature in the history of trade. When we add that the caravans depend almost wholly for subsistence on their guns,

have to hunt the buffalo, defend themselves against hostile Indians, endure the utmost extremes of cold and heat, hunger and thirst, we at once open up a wide field for the imagination of the reader. The work before us, with maps and plates, contains all that is known on the subject, and makes public, for the first time, the whole details of the system, and all so amusingly, so livelily, so cleverly, that we fancy ourselves, when following Mr. Gregg, in the company of a new Robinson Crusoe. The first chapter contains a detailed account of the St. Fè trade, its origin, history, and system, which is succeeded by the commencement of Gregg's amusing, exciting, and exceedingly interesting Journal. The following account of the appearance of the first caravan with which our author travelled is amusing:—

"The heterogeneous appearance of our company, consisting of men from every class and grade of society, with a little sprinkling of the softer sex, would have formed an excellent subject for an artist's pencil. It may appear, perhaps, a little extraordinary that females should have ventured across the prairies under such forlorn auspices. Those who accompanied us, however, were members of a Spanish family who had been banished in 1829, in pursuance of a decree of the Mexican congress, and were now returning to their homes in consequence of a suspension of the decree. Other females, however, have crossed the prairies to Santa Fè at different times, among whom I have known two respectable French ladies, who now reside in Chihuahua. The wild and motley aspect of the caravan can be but imperfectly conceived without an idea of the costumes of its various members. The most fashionable prairie dress is the fustian frock of the city-bred merchant, furnished with a multitude of pockets capable of accommodating a variety of extra tackling. Then there is the backwoodsman with his linsey or leathern hunting-shirt, the farmer with his blue jean coat, the waggoner with his flannel sleeve vest, besides an assortment of other costumes which go to fill up the picture. In the article of fire-arms there is also an equally interesting medley. The frontier hunter sticks to his rifle, as nothing could induce him to carry what he terms, in derision, 'the scatter-gun.' The sportsman from the interior flourishes his double-barrelled fowling-piece with equal confidence in its superiority. The latter is certainly the most convenient description of a gun that can be carried on this journey; as a charge of buck-shot in night attacks, which are most common, will of course be more likely to do execution than a single rifle-ball fired at random. The 'repeating' arms have lately been brought into use upon the prairies, and they are certainly very formidable weapons, particularly when used against an ignorant and savage foe. A great many were furnished, besides, with a bountiful supply of pistols and knives of every descrip-

tion; so that the party made altogether a very brigand-like appearance."

After numerous curious and exciting adventures, we have an account of prairie surgery, which is very novel:—

"Following up the course of this stream for some twenty miles, now along the valley, and again traversing the points of projecting eminences, we reached Walnut Creek. I have heard of a surgical operation performed at this point, in the summer of 1826, which, though not done exactly *secundum artem*, might suggest some novel reflections to a man of science. A few days before the caravan had reached this place, a Mr. Broadus, in attempting to draw his rifle from a waggon muzzle foremost, discharged its contents in his arm. The bone being dreadfully shattered, the unfortunate man was advised to submit to an amputation at once; otherwise, it being in the month of August, and excessively warm, mortification would soon ensue. But Broadus obstinately refused to consent to this course till death began to stare him in the face. By this time, however, the whole arm had become gangrened, some spots having already appeared above the place where the operation should have been performed. The invalid's case was therefore considered perfectly hopeless, and he was given up by all his comrades, who thought of little else than to consign him to the grave. But being unwilling to resign himself to the fate which appeared frowning over him without a last effort, he obtained the consent of two or three of the party, who undertook to amputate his arm merely to gratify the wishes of the dying man, for in such a light they viewed him. Their only 'case of instruments' consisted of a hand-saw, a butcher's knife, and a large iron bolt. The teeth of the saw being considered too coarse, they went to work and soon had a set of fine teeth filed on the back. The knife having been whetted keen, and the iron bolt laid upon the fire, they commenced the operation; and in less time than it takes to tell it, the arm was opened round to the bone, which was almost in an instant sawed off; and with the whizzing-hot iron the whole stump was so effectually seared as to close the arteries completely. Bandages were now applied, and the company proceeded on their journey as though nothing had occurred. The arm commenced healing rapidly, and in a few weeks the patient was sound and well, and is perhaps still living to bear witness to the superiority of the 'hot iron' over ligatures, in 'taking up' arteries."

Then follows a great battle with rattle-snakes, which is very graphic:—

"Rattle-snakes are proverbially abundant upon all these prairies, and as there is seldom to be found either stick or stone with which to kill them, one hears almost a constant popping of rifles or pistols among the vanguard, to clear the

route of these disagreeable occupants, lest they should bite our animals. As we were toiling through the sandy hillocks which border the southern banks of the Arkansas, the day being exceedingly warm, we came upon a perfect den of these reptiles. I will not say 'thousands,'—though this, perhaps, were nearer the truth—but hundreds, at least, were coiled or crawling in every direction. They were no sooner discovered than we were on them with guns and pistols, determined to let none of them escape. In the midst of this amusing scramble among the snakes, a wild mustang colt, which had somehow or other become separated from its dam, came bolting in among our relay of loose stock, to add to the confusion. One of our mules, evidently impressed with the impertinence of the intruder, sprang forward and attacked it, with the apparent intention of inflicting summary chastisement, while another mule, with more benignity of temper than its irascible compeer, engaged most lustily in defence of the unfortunate little mustang. As the contest was carried on among the waggons, the teamsters soon became very uproarious; so the whole, with the snake fracas, made up a capital scene of confusion. When the mule skirmish would have ended, if no one had interfered, is a question which remains undetermined; for some of our company, in view of the consequences that might result from the contest, rather inhumanly took sides with the assailing mule; and soon after they entered the lists, a rifle-ball relieved the poor colt from its earthly embarrassments, and the company from further domestic disturbance. Peace once more restored, we soon got under way, and that evening pitched our camp opposite the celebrated 'Caches,' a place where some of the earliest adventurers had been compelled to conceal their merchandize."

Justice, however, cannot be done to a permanently useful work like the present by a few scattered selections. It is a valuable contribution to general literature, a very necessary and useful addition to our stock of ethnological knowledge, a most amusing, exciting, and delightful narrative. The Indian, hunger, water, and other scrapes described, the hail-storms and hurricanes, the deer, antelope, and buffalo hunts, succeed each other with so marvellous a rapidity as to afford a never-failing source of pleasure, amusement, and information. The account which is given of New Mexico, its origin, discovery, colonization, &c., is invaluable. We have a detailed description of all the animals, both wild and domestic, of the country. The following is by no means the best extract, but it is the shortest.

"Of wild animals there is not so great a variety as in the southern districts of the republic, where they are found in such abundance. The black and grizzly bears, which are met with in the mountains, do not appear to possess the great degree of ferocity, however, for which the latter especially is so much

famed farther north. It is true, they sometimes descend from the mountains into the corn-fields, and wonderful stories are told of dreadful combats between them and the Labradores; but judging from a little adventure I once witnessed with an old female of the grizzly species, encountered by a party of us along the borders of the great prairies, I am not disposed to consider either their ferocity or their boldness very terrible. It was noon, and our company had just halted to procure some refreshment, when we perceived a group of these interesting animals; a dam, with a few cubs fully as large as common wolves, busily scratching among the high grass in an adjacent valley, as if in search of roots or insects. Some of our party immediately started after the brutes, in hopes of getting a shot at them, in which, however, they were disappointed. One or two 'runners,' who had followed on horseback, then made a desperate charge upon the enemy, but the old monster fled to the thickets, without even so much as turning once upon her pursuers, although one of her cubs was killed, and the remainder were scattered in different directions during the general scamper. The sequel of this adventure served to confirm me in the opinion I had of the exaggerated stories in regard to those much-dreaded animals. We had in our company a giant blacksmith and general repairer of wagons, named Campbell, who measured full six feet eight in his stockings, and was besides elegantly proportioned. Independently of his universal utility as 'Jack of all trades,' our colossal friend was in such constant requisition, that he might well have given rise to the western phrase of one being a 'whole team;' for if a wagon happened to be in the mire, he was worth more than the whole team to extract it: he was, in short, the most appropriate subject for a grizzly bear scrape. On the occasion I speak of, Campbell had laid himself down under the shade of a bush, upon the brink of a precipice about ten feet high, and was taking a comfortable snooze while his companions were sporting in the neigbourhood. During the chase, one of the young bears which had been scared from its mother, was perceived galloping down the trail towards our camp, apparently heedless of the company. Several of us seized our guns, and as it sprang across the ravine, through a brake near the spot where Campbell lay, we gave it a salute, which caused it to tumble back wounded into the branch with a frightful yell. Campbell being suddenly roused by the noise, started up with the rapidity of lightning, and tumbled over the precipice upon the bear. 'Whaugh!' growled master Bruin; 'Murder!' screamed the giant. 'Clinch it, Campbell, or you're gone!' exclaimed his companions; for no one would venture to shoot, for fear of killing the man. The latter, however, had no notion of closing clutches with his long-clawed antagonist, but busied himself in vain attempts to clamber up the steep bank; whilst the bear, rising up on his hinder legs, and

staring a moment at the huge frame of the blacksmith, soon made up his mind as to the expediency of 'turning tail,' and finally succeeded in making his escape, notwithstanding a volley of shot that were fired after him."

We then further have a detailed sketch of the arts and sciences, education, dress, government, military, hierarchy, religion, the Pueblos, the wild tribes, &c. Mr. Gregg then takes us back to the United States. Thus ends volume the first of a work not surpassed in interest by any we have lately read. We must conclude our present notice with some slight account of the Mormons, promising to return at an early period to volume second, and in the mean time earnestly recommend the book to our readers.

"On the 11th of May we arrived at Independence, after a propitious journey of only thirty-eight days. We found the town in a thriving condition, although it had come very near being laid waste, a few years before, by the Mormons, who had originally selected this section of the country for the site of their new Jerusalem. In this they certainly displayed far more taste and good sense than they are generally supposed to be endowed with; for the rich and beautiful uplands in the vicinity of Independence, might well be denominated the 'garden-spot' of the Far West. Their principal motive for preferring the border country, however, was no doubt a desire to be in the immediate vicinity of the Indians; as the reclamation of the 'lost tribes of Israel' was a part of their pretended mission. Prior to 1833, the Mormons, who were then flocking in great swarms to this favoured region, had made considerable purchases of lots of tracts both in the town of Independence and the adjacent country. A general depot, profanely styled 'the Lord's store,' was established, from which the faithful were supplied with merchandize at moderate prices; while those who possessed any surplus of property were expected to deposit it in the same for the benefit of the mass. The Mormons were at first kindly received by the good people of the country, who looked upon them as a set of harmless fanatics, very susceptible of being moulded into good and honest citizens. This confidence, however, was not destined long to remain in the ascendant, for they soon began to find that the corn in their cribs was sinking like snow before the sun's rays, and that their hogs and their cattle were by some mysterious agency rapidly disappearing. The new-comers also drew upon themselves much animadversion in consequence of the immorality of their lives, and in particular their disregard for the sacred rites of marriage. Still they continued to spread and multiply, not by conversion, but by immigration, to an alarming extent; and in proportion as they grew strong in numbers, they also became more exacting and bold in their pretensions. In a little paper, printed at Independence, under their immediate auspices, every thing

was said that could provoke hostilities between the 'saints' and their 'worldly' neighbours, until at last they became so emboldened by impunity, as openly to boast of their determination to be the sole proprietors of the 'Land of Zion,' a revelation to that effect having been made to their prophet."

Mexico as it was and as it is, by BRANTZ MEYER; *with numerous Illustrations on Wood, by* BUTLER. London: Wiley and Putnam.

FEW works which we have perused in connexion with Mexico, have given us so much information, pleasure, and satisfaction, as we have received from the one before us. Mexico, the land of Montezuma, where, beyond every other part of America, at the period of discovery, civilization was most widely diffused, where laws, religion, military science, and architecture were carried to a singular pitch of perfection;—Mexico, which, in connexion with the great Captain, Cortez, so wildly and deeply interests us, must ever be a country concerning which every particle of information will be welcome. Baron Humboldt, in his Political Sketch of New Spain, gave us a very able, though heavy insight into Mexican history, statistics, climate, &c.; Ward, more lately, added much to our stock of knowledge; Madame Calderon, in her lively and agreeable way, did much towards familiarizing us with a people, whose manners, customs, and peculiarities are well worthy of study. In Vendall's admirable and graphic account of the famous Santa Fè expedition [a], we obtained an insight into the interior of Mexico, which will scarcely occur again. In the present work, Mr. Meyer, who was American secretary of legation in Mexico, has given us the results of much reading, of great personal experience, of an extended knowledge; he himself says:—

"In my letters on antiquities, and my descriptions of the condition of the ancient empire, I have followed, literally, the productions of Cortez, Bernal Diaz, Clavigero, and Dr. McCulloch. During my residence in Mexico, I passed many hours in the museum, which contains a large collection of antiquities found throughout the republic. Besides this, there are but few persons or works to aid a student in such pursuits. Yet, with my mind alive to the interest recently created by American writers, and a natural affection for every monument of our country's history, I confess that, while I looked with wonder at the uncouth idols of a bloody religion, and the remains of a partial civilization, I desired to convey to others at home some of the mingled amazement and interest with which I found my-

[a] "Military Expedition to Santa Fè," by G. Kendall. London; Wiley and Putnam.

self excited. I desired to do so especially, with the hope that men of leisure and taste for antiquarian pursuits might be led to combine and compare such drawings as I presented, with those more beautifully delineated in the works of Mr. Stephens and other writers; and thus, in the course of time, to produce a connected story of the past. I have done this without pretension to antiquarian lore. I have not presented my own drawings alone in these letters, but have collected others from a variety of valuable works that are too costly for general circulation, or rarely to be found even in the libraries of the rich."

Much, however, as we admire the absolute redundancy of elegant wood-cuts,—much as we are interested in the singular subject of Mexican antiquities, it is that we may preserve some memorial of these red races that are now vanishing like the leaves of their native forests, that we chiefly value the book. In this point of view, the present work is invaluable: and its pleasant chit-chat, its merry, sparkling, and agreeable narrative style, has a charm which very much attaches to the American mode of writing. Even in the gravest there is a quiet under-current of humour, which, amid details of Pyramids of Cholula, of museum and antiquities, of Mexican mythology, priests, temples, and sacrifices of the Mexican calendar, is full of relief.

In addition to a complete account of the manners, customs, arts, &c., of Mexico,—of its people, education, religion,—of its manufactures and commerce,—of the city of Mexico, and singular leper population, we have a "Journey in the Terra-Caliente, being an account of a visit to Cuernavaca, the ruins of Xochicalco, cavern of Cacahuawamilpa, Cuautla de Amilpas;" an account of an ascent to the summit of the volcano of Popocatepetl, and a journey to Tezcoco, which are as amusing, lively, and graphic as any thing in Stephens's very best tours.

The Quarter Deck. By C. R. Cook, M.R.C.S.

This is an agreeable volume, consisting of sketches of sea-life, written in an unaffected style, abounding with good feeling, and a shrewd perception of the peculiarities of the different classes of society. Educated in the medical profession, our author selected the sea-service as the one best calculated to please his fancy, and he has ably sketched the adventures to which his position naturally tended. He has indulged in none of those technicalities which his occupation render familiar to him, but has described his sensations, his feelings, and his actions in a sensible and amusing manner, that cannot fail to render his work a favourite amongst those who love to have their leisure hours beguiled by well wrought narratives, which, whilst they are founded upon reality, have sufficient of imagination about them to invest them with excitement and well kept up interest.

Journal of a March from Delhi to Peshawur, and from thence to Cabul. By Lieut. Wm. Barr. Madden and Co.

Lieut. Barr has filled up a vacant page in Indian history; he has detailed the operations which were undertaken in 1839, by Colonel Wade's auxiliary army, and has materially added to our information relating to the Punjâb, which is hourly becoming more important to us. His descriptions are animated and full of vigorous delineation, his narrative is well told, and adds to the interest which all must take in those extraordinary scenes which have been exhibited in our Asiatic dominions. Did our limits permit us to make an extract, we should have selected the detail of the operations of the Kyber Pass. The narrative of the ascent into the lofty regions, surrounded on every side by precipitous steeps and deep chasms, with the attack upon the enemy, is in a high degree graphic and striking, whilst the illustrations which are given assist the mind in picturing the events which are so well told. Such a volume deserves a wide circulation, and will be prized by those who love to hear how fields were won, and to have registered the names of those who should " in flowing cups be freshly remembered," for the services they have done their country. With the exception of a brief notice, which is to be found in the United Service Journal, there is no other record given to us of the events which occurred, but those with which Lieut. Barr has, with so much ability and judgment, now furnished.

SONNET ON THE DRAMATIC PRIZE.

By the Author of the Prohibited Comedy.

Time was, when mightiest princes and their peers,
  Loving the Muses, were by them repaid
With thanks immortalizing; and if years
  Have this unseemly alteration made,
That One alone, whose plain ungilded name
  Shines but with its own honour, doth the work
Of antique grandeur, rousing the spent flame
  Of genius, or fire-kindling sparks that lurk:
But the more grateful, star-crown'd Sisters! set
  Webster's in your bright rolls!—and if perchance,
Wanting but that one wreath, the Isles should yet
  Snatch laughter's light-hued palm from brilliant France,
A brighter glory be to him accorded
Who roused wit's blaze, than all who but rewarded!

Lausanne, Aug. 10th, 1844.

GEOLOGY.

ON THE CONNEXION BETWEEN THE GEOLOGICAL STRUCTURE OF A COUNTRY AND ITS NATURAL SCENERY.

It is intended in the following pages to bring under the notice of our readers a few facts, in regard to the connexion which exists between the geological structure of a country and its natural scenery. The subject is one of considerable importance, and has not hitherto received that amount of attention which it justly merits. It forms, as it were, a link between those profounder disquisitions on the structure of the earth which belong to the province of geology, and that magnificent array of natural objects which has been so profusely scattered over its surface: and the ultimate object is to point out, so far as that can be done, the causes of those great and marked differences in external appearance, which are presented by different kinds of scenery.

That some relation pertained between the geological structure of any district of country and its landscape, might have been *à priori* expected; because the mechanical and chemical differences which are observed among the various formations which constitute the crust of the earth, might lead us to infer that the ordinary atmospheric agents, by acting with more or less effect on these formations, according to their respective constitutions, would produce certain changes in outline and general appearance, varying in each individual formation.

On more closely examining the subject, however, we shall find that other and more powerful agents have been in operation in bygone ages; and that these also have contributed to the establishment of some of the most important differences about to be described. We shall instance the primitive formations, as illustrating what is here advanced. Let us suppose these rocks in their original position; that is to say, the granite undermost, next the gneiss, the mica slate, and the clay slate. Let us also suppose, that by some great internal force, the earth's crust is rent, and part of it protruded upwards. The granite is a hard massive rock: it is broken across, and thrust upwards against

the superincumbent strata. Now, it is easy to perceive, that unless these resist equally with all points of their surfaces, they will not only be thrown up, but they will also have their parallelism deranged, and one side of the mass will be raised higher than the others, and this would give rise to a well-known geological appearance, that of a central ridge on the sides, of which the upper formations lie with highly inclined planes. From the vertical motion also which we have supposed given to the granite, this rock would be lifted upwards, and form precipices. This may be taken as an illustration of those primeval causes which have been referred to. Let us next suppose these upheaved masses exposed for ages to the action of the atmosphere. It is quite evident that this action would be to a great extent modified by the nature of the rock. If it happened to be soft and easily disintegrated, the mountain would assume a rounded appearance; if the rock, on the contrary, were hard, we should have the outline of the ridge sharp and angled. If the strata were vertical, or nearly so, we should then have another agent at work, and this we find to be the cause of some of the most stupendous modifications of scenery which this globe presents to us. The agent alluded to is cold, and it acts in this way: water, either from rain or the melting of snow, insinuates itself between the strata during mild weather. This is consolidated by the first frost of winter; and the act of freezing in water developes an expansive force that nothing can resist: the strata give way; the water of another summer enters the rents with more facility and in larger quantity. The frost again takes place, and the separation becomes greater at each successive repetition of the process, until huge masses are rent from the summits of the mountains, and thrown down into the valleys beneath. In this way, mass after mass is separated, until the ridge is broken up into detached pinnacles, and, as the process goes on most abundantly at the most elevated part, on account of its being most exposed to the cold, we have gradually formed those magnificent spires of rock, which exist in several formations, particularly in the granite.

It is necessary to mention these few circumstances in order to explain the kind of causes which influence the external characters of particular formations, and we shall now proceed to point out in detail the more prominent varieties which are observable in the different mountain groups, along with the causes which appear best to explain the phenomena. We shall adopt the usual division into primitive, transition, secondary, tertiary and alluvial, and volcanic.

THE PRIMITIVE FORMATION.

Without descending to the minutiæ of geological subdivision, we shall divide the first formation, the primitive, into gra-

nite, gneiss, mica slate, and clay slate. These are not all the rocks of this formation, but they include those larger masses which give character to natural scenery.

The Granitic formation is the oldest with which we are acquainted; it is that on which all the others rest, and before the mountains were elevated, it was throughout the world the lowest in the series; and for that very reason, when the earth's crust was broken up and the mountain ranges formed, this rock from its position became the central ridge of those mountain chains in which it exists, and in this new situation gave rise to one great and marked variety of scenery.

The granitic formation is remarkable for its altitude. Some of the highest, indeed the highest, mountains in Europe belong to it. In other parts of the world it rises even to greater elevation than in this: and in Upper India it forms the loftiest mountain chain on the globe. In describing the appearances of this as well as of other rocks, we shall divide its external characters into altitude, outline, structure of its surface, colour and its relation to vegetable life, along with a few other circumstances, which, while they are not characteristic of every formation, are nevertheless of sufficient importance in particular ones to merit notice.

The *outline* of granitic districts is generally hard, but it varies according to the constitution of the rock. When this is soft, the mountain tops are rounded and dome-shaped, and the general outline is wavy. If, on the contrary, the rock is hard, we have, as has been already stated, the outline sharp and rugged, or shooting up into gigantic pinnacles or spires. Granitic mountains have their sides sometimes elevated to such high angles, that it is impossible for a single particle of earth to rest on them, or a single blade of vegetation to take root; while at others, the mountains are rent from their summit to their base into the most stupendous precipices the imagination can conceive. The chain of the Alps abounds in the grandest specimens of these structures. It is here, indeed, that the scenery exists in its highest perfection. Sometimes we find the mountains furrowed by deep and narrow valleys, at the bottom of which a furious torrent is rolling along; at others, we see them cleft down into ravines so close that the light of the sun can hardly penetrate them. The gloomy valley of Gondo, on the Italian side of the Simplon, is formed in this manner. It is in some places above 1000 feet deep, while its walls are perpendicular or overhanging, and its whole breadth not above 50 feet.

The precipices formed by granite and gneiss have a marked feature in them, and that is their comparative smoothness. They appear almost to have been the result of a single rent. It is seldom that there is any great projection on their surface, but generally they are cut sheer down to an enormous depth, and exhibit throughout their whole extent the appearance of a smooth

wall of naked rock. There are many magnificent examples of this among the Alps, and in addition to those already given, we may instance the Devil's Mountain in the Canton of Uri, and, above all, the tremendous precipices of the Allée Blanche hereafter to be described. The valley of the Upper Hasli in the Canton of Berne, and the mountains on the banks of the Lake of Como, near Chiavenna, afford fine specimens of highly inclined planes of granite; in the first of these, the rock looks like a wall many thousand feet high which has fallen out of the perpendicular.

The *colour* of the rocks of this formation varies in different districts. Around Mont Blanc, on the Simplon, and in the Rhetian Alps, the precipices and sides of the mountains are stained of a dark brown colour, approaching to black, while the granite of the St. Gothard appears as if it were newly split.

The *vegetation* in granite districts is generally scanty, and not unfrequently it is nearly absent; and the reason of this is, that the rock is hard and difficult of disintegration, and consequently cannot afford the soil that is necessary. This circumstance also gives rise to a marked character of its scenery.

The grandest collection of scenery which Europe, or perhaps the world affords, is that presented by the great mountain group of Mont Blanc, and we shall choose this as an illustration of our subject, because it exhibits probably the most stupendous specimen of the granitic formation in existence.

Mont Blanc is a mountain group situated about forty miles south-east of Geneva, in the duchy of Savoy. There are two roads by which it may be approached. The one most generally followed is that from Geneva by Sallenche; the other is a footpath beginning at Martigny in the Valais and crossing the Forclas into the upper part of the vale of Chamouni. We shall describe this latter route, because by following it we shall arrive at a position from which the more remarkable varieties in outline presented by this formation are brought most strikingly into view.

The town of Martigny is situated at the lower part of the Valais, at the junction of four roads. That leading down the Valais towards the Lake of Geneva, the road up the Valais towards the Simplon, the pass over the great St. Bernard, and that over the Forclas to Chamouni. Looking westward from the town, we see two lofty mountains clothed with immense forests and furrowed by descending torrents, and between these there is a valley gradually ascending, until it reaches an elevation at its upper part of about 5000 feet; this is called the Col de Forclas. The footpath lies up this steep valley, and crosses the neck. It then descends the deep ravine of Trient, surrounded on all sides by mountains of great altitude, and at the bottom of which a torrent from the glacier of Trient sweeps along. It is almost impossible to conceive any thing in nature

more still and solemn than this part of the scenery, with its few rude chalets, cut off, as it were, by impassable barriers from all the world.

The road follows the current upwards for about half a mile, and suddenly terminates at the foot of a steep and apparently inaccessible mountain, several thousand feet high, clothed to its summit with gigantic pines. A narrower examination, however, shows a footpath cut in a zigzag direction up its precipitous face, by which the ascent is made. This occupies about two hours, and after another hour's walk along the upper part of the mountain, and partly over the snow, a small hut is reached, built on the summit of the pass, 7000 feet above the level of the sea: this hut is situated on the Col de Balme. The panoramic view which it commands is of surpassing grandeur. Towards the east lies the magnificent snow-clad Alps of the Oberland, and on the west the vale of Chamouni with its incomparable scenery. Language is here of little avail in conveying any idea of the reality. The first comparison that strikes the imagination is, that we are looking on some grand palace of nature, in which the king of mountains is holding his court, surrounded by hundreds of his satellites, and in whose august presence those objects appear as nothing which in other circumstances would awe the very soul. The vast mass of Mont Blanc in its most minute details is visible, and the smooth outline of its hoary summit contrasts in a wonderful manner with the thousand shattered pinnacles of black naked rock, that shoot upwards into the air on all sides, some of them to the height of nearly two miles above the level of the sea. The entire of the left side of the valley is formed by the precipices and needles of Mont Blanc, and the right side by the Brevent; and the altitude of these is so great that in comparison, the breadth of the valley itself is reduced to that of a mere furrow, in which nothing can be discerned but a white waving line, which marks the course of the river Arve. The descent from the Col de Balme to the valley is steep, but not difficult, and occupies about two hours.

The view from the Col de Balme, of which we have attempted to give a faint outline, presents the granitic formation under two of its most striking forms. The summit of Mont Blanc, as seen from this point, is smooth and dome-shaped, and has great harmony of outline. Its curves are regular and gentle, and it sweeps gradually down into the valley beneath. In close junction with the huge body of the mountain, we see the granitic formation shooting upwards almost perpendicularly, and forming vast obelisks, many thousand feet high. The inclination of the sides of these is so great, that the snow cannot lie on them, and this is one cause of the striking contrast they present to the mountain itself. In certain positions, these needles, as they are

called, present a close resemblance to the Gothic spires of some cathedrals. They are, perhaps, above a mile in breadth at their base, and shoot up in groups of pinnacles, gradually diminishing in number as they increase in altitude, until at last the needle is terminated by a point so slender, that there appears to be hardly room enough on it for a human foot to rest. One of the most remarkable of these is the Aiguille de Dru, as seen from the Chalet of the Montanvert, which almost appears as if it had been the model of more than one Gothic structure.

The cause of this peculiar phenomenon in the granitic formation has been already pointed out. It is occasioned by the destroying effects of cold, acting on a rock which in this particular situation is traversed by vertical rents and fissures.

There is still another view of Mont Blanc which is worthy of mention, as being in some points superior to that from the vale of Chamouni. It lies in a part of the Alps which is seldom visited by travellers, and as it presents a most interesting class of appearances, we shall endeavour to give a short outline of its scenery.

In order to visit this remarkable spot, it is necessary to cross the Col de Vosé, which is a lofty mountain pass, situated at the lower extremity of the vale of Chamouni, and close to the side of Mont Blanc. From the summit of this pass the road descends into a deep ravine, enclosed by vast escarpments of rock. It then descends into the wild valley of Condamine, situated to the west of Mont Blanc, and skirts the base of the mountain for several miles. It then makes a steep ascent by a long staircase formed of rude masses of rock, and after crossing several large torrents decending from the glaciers, it reaches the summit of the Col de Bonhomme, 8000 feet above the level of the sea. After crossing the snow for some miles, and commanding on all sides the most sublime views of Alpine scenery, it suddenly descends into the deep valley of Chapui. From the hamlet the road again rises towards the base of Mont Blanc, under a lofty precipice of mica slate, and winds up the steep side of a mountain. It again reaches the snow line, and arrives at the summit of the Col de la Seigne, between 8 and 9000 feet above the level of the sea. It is from this point that the traveller suddenly looks upon the south side of Mont Blanc. No effort of imagination or of art can ever convey to the mind any idea of the glorious aspect which the mountain here presents. On the side next Chamouni, its giant form is clothed in perpetual snow, and its lower part still affords earth enough for vegetation, except where the glaciers move downwards into the valley; and the whole scene, notwithstanding its sublimity, still retains some traces of beauty. But the side towards the Allée Blanche, which we are now contemplating, consists only of black naked rock, forming a succession of nearly vertical preci-

pices, from 8 to 10,000 feet in altitude, and extending for nearly 12 miles in length. The valley runs towards the south-east; the right side of it consists of the snow covered slopes of the Cramont, and the left of Mont Blanc and its needles. The mountain itself appears as if it had been split from the summit to the base into one sheer precipice; and there are enormous masses of naked perpendicular rock, standing upright before it, the apparent altitude of which is not much less than that of the mountain itself. Beyond this, towards the east, extends the long line of aiguilles, amongst which the stupendous forms of the Geant and the Grand Jorasse are conspicuous. There is no slope rising from the valley towards these mountains. The rock appears to spring at once out of the soil, and to rise upwards, until it ends in a point. The lower extremity of the valley is closed up by the Great St. Bernard, and presents altogether the most wondrous group of scenery that it is possible to conceive.

These, then, may be taken as illustrations of the general characters of the scenery of the granitic formation, and we shall only further notice one or two properties of the rock which produce peculiar modifications in those districts where they occur.

Some kinds of granite are broken into huge fragments by the action of cold, and form on the summits of certain mountains great piles of loose rock. Remarkable examples of this occur in the Island of Arran, and among the Alps. This structure is fraught with great danger to the valleys beneath, and several melancholy instances of the disastrous consequences of eboulements have happened in modern times. Not many years ago, a populous village at the foot of the Rhetian Alps was buried under an enormous collection of fragments which fell from the mountain above, and several valleys in the same district exhibit very striking specimens of these falls. In the valley above Chiavenna, nearly a mile of ground is covered by enormous blocks of granite, amongst which groups of large walnut-trees are now growing, the whole forming an appearance of a very unusual kind.

The Mica Slate formation in its general characters differs considerably from granite. The acclivities of its mountains are more gentle, and often exhibit rugged projections and shelves; and it more generally forms mountain ridges than detached mountain masses. Its outline is rough and ragged, and frequently fantastically waved. The precipices it forms are seldom of great altitude, and they are, generally speaking, marked by the occurrence of terraces and ledges in the rock, occasioned by the separation of large tabular masses, by the action of cold. This appearance is sometimes very marked, and we are disposed to consider it distinctive of the formation. When the strata are inclined at a high angle, the process of disintegration necessarily goes on most rapidly at the lower

surface of the rock, and the ridge of the mountain is broken up into a series of the most extraordinary contortions. There is a very singular example of this in the mountains bordering Loch Eck in Argyleshire.

Sometimes the mica slate presents scenery of considerable beauty, and one of the best examples of this is afforded by the upper part of the fine valley of Aosta in Piedmont.

This valley is a continuation of Allée Blanche, and presents a striking contrast to it. Its two sides are formed of sloping ridges of mica slate, rising to an immense height, and having the appearance of a succession of hills piled above each other, clothed in rich verdure, and adorned with the ruins of old baronial castles, built on projections of rock that rise above the general slope of the mountain. The summit of the Great St. Bernard owes its savage grandeur chiefly to its being composed of this rock. The strata are highly inclined, and at that altitude are almost entirely destitute of vegetation.

The colour of the mica slate is a dark grey, slightly tinged with red, and it has a glistening appearance, from the quantity of micaceous scales it contains.

The Clay Slate formation differs from the preceding in the character of its scenery in very few particulars. Its slopes are more gentle and its precipices not so lofty, whilst its vegetation is more abundant. It also forms mountain ranges of considerable extent.

(To be continued.)

METEOROLOGY.—ON THE FORMATION OF RAIN.

By John Joseph Lake.

Mr. Andrew Oliver suggests, in a paper published in the *Transactions of the American Philosophical Society*, that the electric fluid which produces a thunder-storm, rises from the earth with the vapours that are continually ascending. He also says,—"Whatever the immediate cause of evaporation may be, it is certain that the superficial moisture of all bodies is perpetually exhaling in vapours, which ascend into the higher regions of the atmosphere, where they gather and are formed into clouds, and at length recondense, descending in dew, mist, or rain, upon the surface of the earth, from whence they sprang.

"These vapours are either detached in streams from the humid ground by the influence of the sun, or thrown off by the perspiration of those infinite multitudes of animals and plants which cover the face of the earth [a], or supplied by evaporation from the ocean, or other grand collections of water.

[a] Hale's Vegetable Statistics. Chambers's Cyclopædia, art. *Perspiration*.

"Ignorant as we are of the nature of these operations, and of the manner in which they are performed, it is natural to suppose, that the vapours themselves ascend in the same electric state, whether positive, neutral, or negative, with the substances from which they arise. Accordingly, Signior Beccaria, in making some of his experiments, observed, that steam rising from an electrified eolipile, diffuses itself with the same 'uniformity with which thunder-clouds spread themselves and swell into arches, extending itself towards any conducting substance.'[a] This steam then was electrified, as well as the eolipile from whence it proceeded."[b] Mr. Oliver then goes on to show, that in like manner, the vapours which arise from the earth are in the same electrical state with the earth itself.

This hypothesis is adopted by Professor Stevelly, who brought it to the notice of the British Association in 1834, and Mr. Bowall, who laid it before the same body in 1840. But these proceed further, and show how the abstraction of the fluid produces rain. Their opinion is, that each particle of vapour rising through the air carries with it its portion of electric fluid according to its expanded surface; that if it remains within the electrical attraction of the earth, the vapour is condensed, and forms *dew;* but, if it rises beyond the electrical attraction of the earth, and is there condensed, the electricity being insulated, forms an atmosphere round each particle of vapour, and on the removal (by any cause) of the electricity, including the vaporous particles, the repulsion is removed, and they then attract each other, and form rain.

Having observed that there was more rain and less thunder at Belfast than in London, I was led to examine into the cause of the peculiarity, and especially on account of the electric fluid being less abundant in the atmosphere at the latter than at the former place, and found the above hypothesis to agree most perfectly with the peculiarities of the neighbourhood of Belfast, which is surrounded by hills. The highest of these is to the north of the town, and one of them, named Devis, twelve miles from it, is nearly 400 feet above the level of the sea. Whenever any mist or cloud *descends upon* the top of this mountain, it is a sure sign of rain, and I have never observed it rain without some previous indication of the kind, which frequently takes place for hours before the rain comes on. The cause of this appears to be, that Devis, which is conical, acts as a conductor to draw the electric fluid from the clouds, that a portion of the clouds descends with it, and, as the fluid is drawn off, the watery particles in the atmosphere unite and descend as rain.

On the 6th of May last, I had the good fortune to observe a

[a] Priestley's History of Electricity, p. 327.
[b] Literary Magazine and British Review, 1793, p. 415.

remarkable instance of the drawing off the electric fluid from the clouds by this mountain. The weather, in the early part of the day, was clear and warm. Between 1 and 2 P.M. clouds gathered; they became gradually more dense, and were strongly charged with electric fluid. When I first observed them, they were moving from Devis to the west, but the wind, along the surface of the ground, was moving in the opposite direction, namely, towards that mountain. This was before the clouds presented any signs of a strong electric charge; after they assumed this appearance, a slight shower fell, and the clouds and wind at the surface reversed their direction, the clouds moving from Devis, and the wind at the surface towards it. When this shower ceased, the clouds became stationary, and the wind at the surface of the ground ceased, the smoke from the factory chimneys, which had moved in the direction of the surface wind, rising perpendicularly. At this juncture a peal of thunder ensued, and a heavy shower fell; the clouds then remained stationary, and the wind began to blow at right angles to its former direction. It then gradually veered round until it blew direct towards Devis, and the clouds began to move to the same point. In four minutes the shower became very heavy, but in a short time the weather cleared up.

I was so situated that I could not see Devis during the time of this phenomenon, but at 6 P.M. it was repeated, when I was able to attend particularly to it, and watch that mountain. At a quarter past six the clouds had gathered again, and were much charged with the electric fluid. After the occurrence of similar movements to those mentioned above, the clouds became stationary, the wind moving from Devis, the clouds overhanging the mountains became denser and denser, but they appeared to be kept by some influence from touching it, assuming the form of a mould in which the mountains had been cast. After they had remained stationary some time, the wind still blowing from Devis, some fragments of them began gradually to descend to the top of that mountain, a peal of thunder scarcely perceptible ensued, and a body of cloud, sufficient to cover the summit, descended with rapidity and rested upon it, whilst the other clouds began to ascend. Within two minutes after the thunder and descent of the cloud upon Devis, a very heavy rain came on, accompanied by violent gusts of wind. At 8 P.M. the rain had ceased, and the clouds reposed in streaks of white and black, on lines from north-east to south-west.

It does not appear necessary to enter into an explanation of these phenomena, or to compare them with the above theory. To the electrician, the activity and operation of the electric fluid in them will be manifest, especially at the close, when by a sudden discharge the watery particles were released, and the cause of their mutual repulsion being removed, they descended in heavy rain. It was also perfect satisfaction as to the cause

of there being less thunder and lightning and more rain at Belfast than London; for as soon as electric clouds gather, they make towards the mountains, especially Devis, which draw off the fluid, and thus discharge the rain; but London being on a great level, without mountains, there are no such means to conduct the electric fluid from the clouds.

In like manner, more rain falls in London itself than in the surrounding country, for the steeples and numerous and lofty points presented by that city to the clouds attract them to it, and drawing off the fluid, cause them to descend in rain. And it is to be observed, that there is more rain in the neighbourhood of Belfast, than in those parts of the country sufficiently removed from the influence of the mountains surrounding it.

Hence we may presume it arises that mountainous countries and districts are so subject to rain, and that mountains themselves are so frequently and suddenly visited by gusts of wind and showers.

PROJECTILE WEAPONS OF WAR AND EXPLOSIVE COMPOUNDS.

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(Continued from p. 271.)

Ancient Artillery.—The term artillery, as formerly applied, had a very different signification to that which we now assign to it, the word being pretty nearly synonymous with *archery*. In the present instance, however, we do not intend employing it in that sense; we mean it to comprehend a list of those larger machines of projectile warfare which were used in place of the modern cannon.

No sooner did the spread of civilization cause men to assemble in communities, and prosecute the arts which are inseparable from such a condition, than increasing wealth began to incite the cupidity of the civilized races. Towns were now built, and surrounded with lofty walls, to attack which engines of great size and power were necessary. Great as is the increase of power conferred, by gunpowder, to the modern artilleryman, and wonderful as is the precision to which artillery practice is now brought, it must be confessed that a higher order of genius was necessary to the ancient engineer. To him the whole region of mechanical science was an open field on which he might exercise his constructive skill; levers, pulleys, and springs might be employed in thousands of varying arrangements, forming collectively engines of terrific force, whereas the modern engineer, so far as regards the formation

and use of weapons, is restrained within very narrow limits; to employ, in short, the explosive force of gunpowder, either in a tube for the purpose of projecting a ball; in a tube which may be itself repelled; in a shell; or in a mine. So great is the force of gunpowder, and so constantly are our ideas associated with the fact of its being now solely employed to project large bodies, for the purpose of battering down walls, that on rising from the contemplation, we begin to wonder that any other agent could have been capable of similar effects. One circumstance usually escapes our notice,—that the momentum of a projectile, or the force with which it impinges upon an object, is equal to its weight multiplied by its velocity. True, the ancient engines of war could not project a mass with the same velocity as a cannon projects a ball; but then those masses were so much larger, and heavier than any cannon ball, that the comparatively small initial velocity was compensated for.

The structure of fortifications, and that of offensive engines, must mutually influence each other. In ancient times, before the invention of fire-arms, the strength of cities depended on the height of their walls; *now*, this would constitute a weakness; whilst, on the other hand, our modern, low, fortified walls, would have been no defence against the ancient mode of attack.

As we have already remarked, the forms of ancient engines of war were very many, differing according to the taste or constructive skill of the architect: they may, however, be included in the following classes:—

1. Catapultæ and balistæ, or engines formed on the principle of the cross-bow.

2. Instruments formed on the principle of the sling.

3. The battering ram.

4. Towers of war, from which projectile weapons were thrown [a].

[a] The chief engines of war of the ancient Greeks and Romans were the aries, catapult, balista and onager, slightly altered in shape, occasionally, without doubt, in order to accommodate them to particular services. These machines remained in vogue until considerably after the discovery of gunpowder, yet designated by a great variety of names. When we consider that the historians of those periods were monks, totally unacquainted with the details of the art of war, and possessing but a crude knowledge of mechanics, we shall not wonder at this multiplication and confusion of names. The principal military engines of the 11th and 12th centuries were, exclusive of the balista, catapulta, onager, aries, and scorpion, the mangonel, trebuchet, petrary, robinet, mategriffon, bricolle, beugle or bible, espringale, matafunda, ribandequin, engine à verge, and war wolf.

The beugle or bible, was an engine for throwing large stones, as we learn from an ancient poem.—

"Et pierres grans et les perrières
Et les bibles qui sont trop fières;
Gétent trop manuement."

(From the romance of Claris, in the French king's library, No. 7534.)

The Catapult.—So easily is the common bow made a cross-bow, and so wide are the limits of size within which the cross-bow can be made, that the formation of gigantic engines of this kind was not a very elaborate suggestion to the mind of its first inventor;—thus originated the catapult and the balista; both engines of the cross-bow kind, but employed for different uses, one throwing darts, and the other stones [a].

Without diagrams to illustrate the subject, it would be of no great service to describe minutely such accounts of those instruments as have been handed down to us; suffice it to say, that, in making those enormous cross-bows, a very curious expedient was resorted to in order that an increase of elasticity might be gained. Instead of making the bow out of one piece of substance, it was formed in two parts, each of which was merely a straight arm. To form the machine, each piece, at its mesial extremity, was closely matted in amongst the fibres of a rope placed vertically, and firmly secured at either end. From this arrangement it is evident that the bow could not be bent without producing great tension of the ropes, thus adding another force to that of the resilient steel. A windlass, or capstan, was employed to bend these enormous bows, and when bent, the string was secured by a catch and iron pin. In order to discharge this machine, the pin was suddenly knocked out by the blow of a mallet.

Catapultæ have occasionally been employed in modern warfare. There was one erected at Gibraltar, at the desire of Lord Heathfield, by General Melville. It was for the purpose of throwing stones a little way over the edge of the rock, in a particular place where the Spaniards used to frequent, and where they could not be annoyed by shot or shells. Of all the machines which were formed on the principle of the sling, that called *onager* is the best known, and may be regarded as typical of the others. Its force entirely depended upon the torsion of a short thick rope acting upon a lever which described an arc of a vertical circle. Its construction may be very well illustrated by the common toy, of a *jumping frog* or *mouse*. Most people have seen these little articles of amusement, and to such, a de-

For a detailed account of these engines, see Grose's Military Antiquities. vol. i. p. 382.

[a] The terms *catapult* and *balista* have been generally confused, by most who have written on the subject.—M. Folard, in his "*Traité de l'attaque et de la defence des Places des anciens*," considers that the catapult was the same as the *onager*, an instrument of the sling kind. In favour of this opinion he can show no evidence; while, on the other hand, there is authority directly opposed to his statement. *Heronis ctesibii Telefactiva* represents it as a cross-bow with two straight arms, the opposed ends of which were respectively embedded in the cords of a vertical rope: moreover, ancient writers constantly confounded the term *balista* with *catapult*, which is another argument in favour of their similarity. In our ancient law Latin, the term catapulta signified a sling.—Grose's Military Antiquities.

scription is unnecessary; for others, however, who have not seen them, the following description will be intelligible. The tail of the animal is a flat piece of wood imbedded in a short twisted rope, in such a manner that the end of the tail projects naturally in a horizontal position from the body of the animal. Under the body is a lump of wax to which the tail, bent forcibly under, is attached, and the instrument placed flat upon the ground. Gradually the tail separates from the wax with a sudden spring, and the animal is projected upwards and forwards. The *onager* was a machine formed then on exactly similar principles; the lever had attached to its free extremity a sling; or sometimes it merely terminated in a spoon-shaped cavity; when bent back, it was secured by a catch or trigger, and charged with a stone. On starting the catch or trigger by a sudden blow with a mallet, the lever described its arc of a circle with great velocity, and projected the stone to a considerable distance.

The Battering Ram.—Of all the ancient projectile weapons, none was so efficacious, or has retained its celebrity so long, as the battering ram. Strictly speaking, it was not a projectile weapon, in the modern and usual acceptation of the term; literally, however, it comes within the limits of that denomination, and under no circumstances can its description be omitted in a treatise having the objects of our own in view. The enormous size of this celebrated machine, the number of men used in working it, and the magnitude of the effects which it was capable of producing, might well awaken our incredulity, were they not attested by abundant evidence, and confirmed by modern experiment. The battering ram consisted of a long pole or spar headed with a huge mass of iron or brass, usually shaped like that portion of the animal which conferred upon it the distinctive name. This spar was sometimes mounted on wheels, but more frequently suspended by cords from a triangle of stout beams. In either case the object was to impel it violently forward against an opposing wall; not with a view of its penetrating the mass, or even of dislodging a portion by its immediate shock, but to set up a vibration that, continually repeated, shook the strongest walls to their foundation, and eventually made them fall.

Originally, the battering ram was probably nothing more than a long beam, which the soldiers carrying in their arms, urged by mere manual force against any obstacle that might oppose itself to them; the suspension of the beam from a triangle, or the mounting it upon wheels, was a self-evident suggestion, that required no great amount of constructive ingenuity to appropriate. Vitruvius affirms that the *aries* or ram, in its simplest form, was first used by the Carthaginians when they laid siege to Cadiz; that *Pephasmenos*, a Tyrian, afterwards contrived to suspend it with ropes; and that finally, *Polydas*, the Thessalian, mounted it on

wheels, at the siege of Byzantium under Philip of Macedon. Pliny, however, states that the ram was used at the siege of Troy; and thus the fable of the wooden horse was allegorical. Some have ascribed the invention to *Artemorus*, a Greek architect, who flourished 441 years before Christ. Others have imagined that the rams' horns mentioned by Joshua as causing the fall of the walls of Jericho, were merely figurative of this instrument.

The ram was usually of enormous dimensions. According to Plutarch, Marc Antony, in the Parthian war, used a ram of 80 feet long; and Vitruvius states that they were sometimes made 106 and sometimes 120 feet long. We may easily suppose that a great number of men must have been absolutely required to wield so enormous a machine, in fact, a whole century of soldiers was employed for this purpose, and when tired, they were relieved by others, so that the vibrations produced were continuous. Modern writers on artillery have made some interesting calculations relative to the comparative force, between the battering ram and cannon balls. Dr. Desaguliers[a] has shown that the momentum of a battering ram 28 inches in diameter, 180 feet long, with a head of cast iron of one and a half tons, the whole ram weighing with its iron hoops 41,112 pounds, and moved by the united strength of 1000 men, would only be equal to that of a ball of 36 pounds weight shot point blank from a cannon. In this calculation, however, a very important element has been omitted, namely, the size of the impinging extremity of the battering ram, which, if its penetrating effect is to be compared with the penetrating effect of a 36 pound ball, should not be of greater size than the latter. Doubtless, however, it was of greater size, and therefore the momentum of the impinging extremity was diffused over a larger surface: thus the penetrating effect of the instrument would be considerably diminished, whilst its concussing, or vibratory and disintegrating effects would be increased. Now against the tall walls of ancient fortifications, these latter qualities were far more destructive than mere penetration. If a slate stone be fixed erect on an edge, and struck with a bullet urged by gunpowder, the chances are that the stone will be perforated, but not thrown down; if, however, the bullet be impelled against it by the hand, the stone will certainly not be perforated, but, on the other hand, will most likely fall. The two cases afford a very good illustration of the difference in effect between the modern cannon and the ancient aries: the former impels a projectile with great velocity, against an object, and penetrates and shatters, without much disturbing the repose of masses situated near its point of impingement; the latter possessed comparatively little penetrating force, but shook the strongest walls to their foundations. Many curious instances might be mentioned of the great effects pro-

[a] Lectures, vol. i. p. 65.

duced by periodic vibrations; one of the most familiar, perhaps, is the well known result of marching a company of soldiers over a suspension bridge, when the latter, responsive to the measured step, begins to rise and fall with excessive violence, and if the marching be still continued, most probably separates in two parts. More than one accident has occurred in this way, and has led to the order (we believe) that soldiers in passing these bridges, must not march, but simply walk, out of time.

Another curious effect of vibration in destroying the cohesion of bodies is the rupture of drinking glasses by certain musical sounds. It is well known that most glass vessels of capacity, when struck, resound with a beautifully clear musical note of invariable and definite pitch, which may be called the peculiar note of the vessel. Now if a violin or other musical instrument be made to sound the same note, the vessel soon begins to respond, is thrown into vibrations, its note grows louder and louder, and eventually may break. In order to insure the success of this experiment, the glass should not be perfectly annealed; however, the *tendency* to break is invariably the same.

As the peculiar genius of modern artillery lies in perforating substances, one great quality of the battering ram has since the introduction of fire-arms been in great measure lost; engineers now, however, are beginning to see the advantages arising from the use of hollow shot, fired with diminished charges, by which means large masses are projected with diminished velocity, thus increasing their shattering, but diminishing their penetrating effects.

The battering ram, although sometimes used as we have described it, was more generally employed in connexion with a vast tower called *testudo*, which we shall now proceed to describe [a]. It must be premised that the walls of ancient cities were of an amazing altitude, and therefore warriors placed on them encountered their opponents at a great advantage. Against such defences as these soldiers armed with manual weapons availed but little, except by some means they could gain an elevation which commanded the city walls. This object was accomplished by employing towers of enormous magnitude [b]. Hero distinguishes three kinds of them; the smallest were, he says, sixty cubits, and five stories high; the base, which was square, measured on each side, seventeen cubits. The larger towers were ninety cubits high, and consisted of fifteen stories; the greatest, called *double*, were of twenty stages,

[a] The terms Vinea, Pluteus and Helepolis were also applied to these towers.

[b] Sometimes, too, by expedients of greater ingenuity. Belisarius conquered Palermo by sailing into the harbours, elevating his boats to the mast head, and from thence assailing the garrison.

were largest at bottom, and decreased every story. These towers were supported on wheels of enormous size and strength; six was the number for the smaller towers, and eight for the larger ones. The lower story was devoted to the battering ram, all the others were filled with archers, and light-armed soldiers generally. These large towers being brought up close to the fortifications, and overlooking them, became very dangerous machines, and consequently many expedients were devised for their destruction. Large excavations were made under the tract along which the machine must pass, in such a manner that its vast weight, not being supported by the superficial crust, made it sink into the snare. Arrows furnished with combustible materials were shot against it from bows and military engines, to guard against which the machine was usually covered with raw hides or metal scales, and hence the name of testudo, which eventually the whole engine acquired. If despite these precautions it nevertheless succeeded in arriving close up to the city walls, vast stones were thrown upon it;—boiling water, melted lead, hot sand, and in short, every material of annoyance which circumstances or ingenuity enabled to be used, was thrown upon the hapless warriors. Nooses of rope or chain were let down from the walls, and in these the head of the battering ram was entangled. Bags of wool, hurdles of wicker-work, and other soft and yielding materials were lowered, for the purpose of encountering the blows of the ram, and diminishing their violence. Not unfrequently these measures succeeded, for, unquestionably, in this primitive developement of the art of siege, the assailed were more favourably circumstanced than the assailants. If, however, the testudo still maintained its ground unscathed, its occupants next threw out a drawbridge[a] across the chasm, and rushed across it to the fortification.

Such is a description of the towers used by the ancient Greeks and Romans, as related by Vitruvius, Ammianus, Marcellinus, and other writers on these subjects. The towers or belfries of more modern times were never so large, rarely exceeding two or three stages in height. These machines underwent very little, if any, alteration in form down to the period of the discovery of gunpowder. In the dark ages, however, we find them mystified by a great variety of fanciful names, amongst which we may enumerate the *sow*, a term frequently applied, in later periods, to those moveable towers. This name is said by some to have been derived from the circumstance of the contained soldiers lying closely together, like pigs under a *sow*, and hence the witty, but not very delicate remark of a certain Countess who defended the castle of Dunbar against King Edward III., in threatening, that unless the Englishmen

[a] Called *Exostra.* Vegetius *de Re Militari.*

kept their sow better she would make her cast her pigs. This circumstance is mentioned by Camden, who also says, "the sow is still used in Ireland." During the siege of Corfe Castle, by the Parliamentarians, they used two machines of the above kind, one named the boar, and the other the sow.

With regard to the power of ancient artillery, it is probable that we cannot have in the present day any very correct notions. Judging, however, from the materials used, and the mode of their application, it must have been very great, although not comparable with that of missiles urged by gunpowder. Athenæus speaks of a catapulta which was only one foot long, and threw an arrow to the distance of half a mile. Other engines, it is said, could throw javelins from one side of the Danube to the other. Balistas threw great beams of wood, lances of twelve cubits long, and stones that weighed 360 lbs. Polybius mentions that balistas were used to throw stones against vessels entering into port. Josephus too, has related several instances of the power of ancient artillery: he tells us they beat down battlements and corners of towers, and overthrew whole files of soldiers, even to the rear rank. He says that one of Vespasian's rams, which was only ninety feet long, and which was smaller than many Grecian rams, had a head as thick as ten men, and twenty-five horns, each of which was as thick as one man. Its weight was 1500 talents (171,000 lbs. troy.) When removed entire, 150 yoke of oxen, or 300 pairs of horses and mules, were required to draw it, and the united strength of 1500 men was employed in forcing it against the walls. Such are the accounts of effects produced by missile engines employed by the Greeks and Romans; and scarcely less terrible are those related of the same engines or their derivatives, when used in more modern times, although the mechanical skill of the ancients was then in great measure lost. It would seem, however, that our ancestors, in describing the military engines of the dark ages, must have greatly exaggerated their effective range and powers; otherwise, many of our ancient castles would not have been built in situations where they could be commanded by hills at a distance of four or five hundred yards from them, instances of which may be seen in the castle of Dover, once deemed the key of this kingdom, also of Corfe and Guildford. Monsieur Joly de Mezeray says, that the greatest range of a mangonel was five stadia, or 1042 yards. These machines not only threw large darts and stones, but also the bodies of men and horses, as is mentioned more than once by Froissart.

Our account of antient weapons being merely preliminary to an investigation of the properties and effects of gunpowder, as well as other explosive substances, we shall not go into further details concerning them, but will presently enter upon the other branches of our subject. Interesting as it may be to

raise up before our imagination engines of bygone times;—the ponderous ram, battering against the lofty walls of an ancient city;—the catapult and balista, hurling their darts and massy fragments; barbed arrows glancing from coats of mail, and encounters of gallant knights and squires bold; we cannot forget that fiction every now and then weaves her misty web around those records of former deeds where truth should reign supreme. Gladly then we hasten from such dim and dusky periods to those of later date;—when other sciences besides mechanics lent their aid to the perfection of the warlike art. The reader will already have anticipated that our allusion refers to gunpowder, the most potent aid which chemistry or any other science ever proffered to the grim deity of war.

Between the balista and catapult, and other mechanical agents of war, and gunpowder, there is, however, a connecting link,—namely,

THE GREEK FIRE,

concerning which such marvellous accounts have been promulgated. Indefinite and variable as were the terms applied to chemical substances, until comparatively recent periods, it is not wonderful that we have received no credible testimony as to the composition of this celebrated Greek fire; nor, indeed, as to the period of its original discovery. It is pretended by some, that its composition was known to the Greeks of antiquity, but that we had no precise accounts concerning its use, until the period of the Eastern empire. This assertion is, however, very improbable, and seems invented by one of those zealous enthusiasts, who assert that, not only were the ancients preeminently felicitous in their sculpture, poetry, and indeed the fine arts in general, but also that they excelled in all branches of scientific acquirements,—that the blaze of intellect in those days irradiated the whole domain of human learning, beyond the limits of which reason could not penetrate; in short, that the apparently brilliant results of the inductive process are a fallacy; that they are merely so many gems known to the ancients,—buried amidst the intellectual ruins of the middle ages, and now restored again. It is certain enough, that we have no precise mention of the Greek fire in any ancient Greek or Latin author[a]. Gibbon appears to entertain no doubt of its invention by the Greeks of Constantinople, and of its having been subsequently stolen from them by the Saracens. According to Beckmann[b], it was invented in the year 678 of the Christian era, by Callinicus, an architect of Heliopolis, (the city afterwards called Baalbec,) in the reign of the emperor Constantine Pogonatus, and its use was not discontinued in

[a] Something like it is alluded to by Quintus Curtius.

[b] Beiträge zur Geschichte der Erfindungen.

the East until the latter end of the thirteenth century. Procopius, in his history of the Goths, calls it Medea's oil, considering it as an infernal composition, prepared by that sorceress. The writer of the "Esprit des Croissades" asserts, that it was known in China in the A.D. 917, three hundred years after Constantine Pogonatus,—that it was called *the oil of cruel fire*, and that it was carried there by the Kitan Tartars, who in their turn had it from the king of Ou. It is far from improbable that many Eastern nations used a liquid composition of this kind in their wars, and that it was discovered by several parties having no communication with each other. We know that in Persia, also in the Island of Zante, and many other parts of the world, there are naphtha springs, which continually pour out this inflammable liquid; we also know that the Parsees, or fire-worshippers, employed naphtha in supporting their religious flames. All they found necessary to do for this purpose was to insert one end of a cane a little way under the earth so impregnated with naphtha, which ascended by capillary attraction, and was easily ignited. Now, it is well known, that large districts are furnished with these naphtha springs, and a substance of properties so obvious could hardly escape being applied to the uses of war. Probably, then, naphtha was the basis of the Greek fire. We can hardly expect at this time to discover any trustworthy account of the operation of this compound, although many statements, such as they are, have been handed down to us. Nothing conduces so much to originate historic inaccuracy as fear, under the influence of which have been perpetuated the most inaccurate exaggerations. Terrible were the reputed effects of ancient cannon, and yet they were altogether incomparable to those of modern days; and the citizen of Leyden, who first received an insignificant shock from an electric jar, protested that he would not be subjected to such another for all the kingdoms of the earth!—yet the employment of fire-arms was coeval with the re-illumination of the moral horizon;—and the discovery of the electric jar took place when the genius of inductive philosophy was rapidly pursuing her victorious career: we need not wonder, then, that accounts of the Greek fire, handed down to us as they have been by ignorant and credulous scribes, and from periods of much greater mental darkness than those to which we have alluded, should be unworthy of implicit credence. It is more than probable that different pyrotechnic contrivances have been unwittingly confounded with the celebrated Greek fire. Joinville favours us with a description which would seem to refer not so much to a burning liquid, as to a *rocket*, which we know has been used as an instrument of war in India and China from time immemorial [a]. Joinville

[a] It is a common idea that Sir William Congreve was the first to introduce rockets as warlike instruments. Such, however, is not the case; he him-

says, "it was thrown from the bottom of a machine called a petrary; and that it came forward as large as a barrel of verjuice, with a tail of fire issuing from it as big as a great sword, making a noise in its passage like thunder, and seeming like a dragon flying through the air, and from the great quantity of fire it threw out, giving such a light that one might see in the camp as if it had been day." Such was the terror it occasioned among the commanders of king Louis's army, that Gautier de Cariel, an experienced and valiant knight, gave it as his advice, that as often as it was thrown, they should all prostrate themselves on their elbows and knees, and beseech the Lord to deliver them from that danger against which He alone could protect them. This counsel was adopted and practised; besides which, the king, being in bed in his tent, as often as he was informed that the Greek fire was thrown, raised himself in his bed, and with uplifted hands thus besought the Lord: "*Good Lord God, preserve my people!*" Geoffry de Vinesauf, who accompanied king Richard I. to Palestine, says, that "with pernicious stench and livid flame it consumes even flint and iron, nor could it be extinguished with water."[a] The following Latin rhymes, composed by a Florentine monk, show the opinion which was in his time held of its properties:—

"Pereat ô utinam ignis hujus vena
Non enim extinguitur aquâ sed arenâ
Vixque vinum acidum arctat ejus pœna
Et urinâ stringitur ejus vise habena:
Ignis hic conficitur tantum per paganos
Ignis hic exterminat tantum Christianos
Incantatus namque est per illos prophanos
Ab hoc perpetuo Christe, libera nos!"

The Greek fire was more extensively employed in European warfare than some have imagined. *Pere Daniel* relates that Philip Augustus, King of France, having found a quantity of it ready prepared at Acre, brought it with him to France, and used it at the siege of Dieppe, for burning the English vessels in that harbour. It was also, according to this author, employed in many other sieges in France. He also states, that a Frenchman named Gaubert, a native of Mante, discovered the plan of making it. Another Frenchman, named Dupré, is also said to

self claims no such priority of invention, but candidly states, in his treatise on the military use of rockets, that he was aware of their having been employed from time immemorial in India and China. There are several Chinese war rockets now to be seen at the Adelaide Gallery of Practical Science. They were taken at Amoy. In point of size, they are much smaller than any used in our service; their case is made of paper, and they carry a barbed dart. Their stick, as might be expected, is lateral and not central, as the modern Congreve rocket.

[a] L'Esprit des Croissades.

have discovered its composition. And on the authority of Grose[a], an Englishman was fortunate enough to unravel the secret, and that the king being unwilling to have it made known, conferred on him a pension to suppress it. According to the testimony of an Icelandic MS. entitled "Speculum Regale," and supposed to have been written in the 13th century, the Greek fire, or something resembling it, was then commonly employed in Europe. The writer says, *Omnium autem quæ enumeravimus armorum et machinarum præstantissimus est in curvus clypeorum gigas flammas venenatas eructans.*

The Greek fire was employed in Europe long subsequently to the discovery of cannons, particularly in sieges. In 1383, when the Bishop of Norwich besieged Ypres, the garrison is said to have defended themselves so well, and particularly with Greek fire, and *certain engines called guns*, that the English were obliged to raise the siege with such precipitation, that they left behind them their great guns, which were of inestimable value. Afterwards the remainder of that army was besieged in the town of Barburgh by the French, who threw such quantities of Greek fire into it, that a third part was burnt, and the English were obliged to capitulate[b].

So terrible are the reputed effects of this celebrated compound, that a knowledge of its true composition would be of exceeding interest. Several recipes have, indeed, been preserved to our own days, but they differ remarkably, and are all of them more or less inconsistent with the reputed effects of the substances. We must remember, however, that those effects were on the one hand doubtless exaggerated, and that the names of chemical substances employed were naturally ambiguous, and perhaps studiously made so[c]. The oldest prescription relative to the composition of the Greek fire, and the one seemingly most worthy of credence, is that mentioned by the princess *Anna Comnena*, in which the component parts are said to be resin, sulphur and oil. It has not, however, been found possible to produce a substance out of these ingredients at all like the reputed Greek fire; theory, indeed, would indicate that saltpetre ought to be one ingredient; this, however, is not mentioned. Nevertheless, we have abundant testimony, as we have proved, that it was a fluid, and that its knowledge was not confined to the Greeks. Moreover, during the crusades,

[a] Mil. Antiq. vol. i. p. 380.

[b] J. Walsingham, pp. 303, 4.

[c] As an instance of the ambiguity of ancient chemical terms, and of certain modern ones, we may remark, that Pliny frequently mentions *alum*; but there is very little doubt that our alum was not then known, and that he refers to rock salt. Again: the modern popular term *copperas*, does not refer to a preparation of copper, as might be imagined, but to a compound of iron,—such are the fallacies of terms.

the Saracens frequently employed it with success against the Christians, as we have already mentioned[a], and the armies of Genghis Khan[b] seem to have been furnished with it. One chief purpose for which this extraordinary fire was employed, was to annoy the enemy in naval engagements; it was then thrown from large engines, or sometimes, it would seem, blown through tubes. Fire ships also were filled with it, and sent loose amongst a hostile fleet, and vessels containing it were shot from balistæ. Genghis Khan is said to have had in his army elephants furnished with these fire tubes. It is a common opinion that in losing the composition of the Greek fire, we have lost an aid to war of far greater potency than gunpowder itself. This, however, is a mistake; the very fact of the Greek fire being a liquid would render it inapplicable to the purposes of modern warfare. If a liquid possessing the reputed qualities of Greek fire were desired, chemists would soon elaborate it in greater perfection than the Greeks of the eastern empire, or Genghis Khan, or any other semi-civilized people. It is not consonant with the genius of modern warfare, and therefore has fallen into disuse. Bonaparte is reputed to have known the composition of the Greek fire, or at least a fluid closely resembling it, but considered it inapplicable. His opinion must be decisive of the question: all know how ardently he promoted the advancement of science; how he cherished the now obsolete sentiment that a sovereign's personal encouragement of science, might be conducive to the public weal; how he attached to his court and loaded with honours the celebrated chemist Berthollet. Doubtless, under circumstances so favourable, had Napoleon wished to possess an inflammable liquid, similar to the Greeks, his chemists could have supplied him. We repeat, then, that under these circumstances, if this compound had been adapted to the purposes of war as the art now exists, it would have been reintroduced.

We now come to the subject of gunpowder,—an invention which not only materially affected the art of war, but exercised most important influences on the fate of empires, and the progress of civilization. As might readily be imagined, the honour of a discovery so important, has been claimed for more than one individual. Polydore Virgil, and Thevet, attribute the invention to a monk, named Constantine Anelzen, who was a chemist of some celebrity in his time. Others maintain that it was discovered by Bartloldus Schwartz, about the year 1320. It is not difficult, however, to refer the invention to a period long anterior to the time of Schwartz, our own illustrious countryman, Roger Bacon, having distinctly mentioned it in

[a] L'esprit des Croissades, &c., Amsterdam, 1780.
[b] Patio de la Croix, *Histoire de Genghis Khan.*

the year 1267 [a]. He describes its composition, enumerates some of its properties, and recommends its explosive powers as a means of destroying armies. He describes it as making a sound like thunder, and a flash similar to lightning, but exceeding the sound and brightness of natural thunder and lightning. He says it might be applied to the destruction of armies, and speculates on the probability of its employment by Gideon, when he defeated the Midianites with three hundred men [b]. Bacon is usually said, by Englishmen, to have been the *inventor* of gunpowder, but a slight examination of the treatise alluded to will convince any unprejudiced person that he, far from laying claim to the invention, mentions gunpowder as a substance well known in his time, and employed for the purpose of pyrotechnical display. The passage alluded to is as follows: ***Ex hoc ludicro puerili quod fit in multis mundi partibus scilicet ut instrumento facto ad quantitatem pollicis humani ex hoc violentiâ salis qui salpetræ vocatur tam horribilis sonus nascitur*** (this is the description of a parchment cracker) ***in ruptura tam modicæ pergamenæ quod fortis tonitru rugitum et coruscationem maximam sui luminis jubar excedit*** [c].

We can easily then shift the claim from Bacon to an anterior date, and Dutens [d] imagines he must have derived his knowledge from Marcus Græcus [e], who not only mentioned the ingredients of gunpowder, but gave better proportions of their substances than many of later date. In the Latin quotation which we have just made from one of Bacon's treatises, saltpetre alone is mentioned as being the horribly explosive substance; but saltpetre alone will not even burn, much less explode; a fact which, the presumption is, Bacon must have known. The question, however, does not rest on presumptions; Bacon himself, in his treatise ***De secretis operibus Artis et Naturæ et de nullitate magiæ***, says that from "saltpetre ***and other*** ingredientes we are able to make a fire that shall burn at any distance we please." In another part of the treatise he gives us a little more information, the words are these: "Sed tamen salis petræ, ***lura nope cum ubre*** et sulphuris, et sic facies tonitrum et coruscationem, si scias artificium." Here two ingredients, saltpetre and sulphur, are plainly enough in-

[a] His works were published this year at Oxford.

[b] Judges, chap. vii.

[c] See preface to Jebb's edition of *Bacon's Opus Majus*.

[d] *Inquiry into the Origin of Discoveries attributed to the Moderns*, by the Rev. Mr. Dutens.

[e] The MS. of Marcus Græcus, which has given rise to this supposition, is still in the Royal library at Paris. Both Dr. Mead and Dr. Hutton had a copy of it: Dr. Jebb also mentions it in his preface to Bacon's *Opus Majus*. The MS. is entitled *Liber Ignium*. Marcus Græcus lived about the end of the 8th century.

dicated, but what can be the ingredient called *lura nope cum ubre?* This obscure fragment of Latinity might puzzle the ghost of a Scaliger; nevertheless, some admirer of the great Friar has succeeded in proving that the barbarous words are merely a transposition of the letters *carbonum pulvere!* Those who are accustomed to admire the liberality of sentiment possessed by cultivators of modern science, and are unacquainted with the more circumscribed views and oblique sentiments of such as cultivated science in the ages of alchemy, will marvel at the pains which Bacon was at to preserve the secret, especially when it need not have been alluded to at all. Bacon, however, in following this course, merely subscribed to the doctrines of his age. Volume upon volume has been written on the art of making gold and silver alone; every operator represents himself successful, but unfortunately the steps of his process are totally unintelligible. However, let us do the alchemists justice. They must needs write books, or their characters would have suffered: these books were intended to pass for oracles of wisdom, but the writers unfortunately had nothing to teach; they therefore employed a jargon of impenetrable mystery, perhaps the best substitute for wisdom in their age or ours.

If Bacon, then, did not discover gunpowder, to whom shall we refer it? Numerous documents can be adduced to prove that gunpowder was known in the East at periods of very great antiquity, and it might have been introduced into Europe, either through the medium of the Greeks of Constantinople, or the Saracens of Spain. Citizen Langles, in a memoir read before the French National Institute, contends that gunpowder was conveyed to us by the Arabs, on the return of the crusaders, and that the former people employed it at the siege of Mecca, in 690. He says they derived it from the Indians [a]. At the period when Roger Bacon lived, Spain was the favourite seat of literature and art. Unlike their rude and turbulent predecessors, whose sole object was the extension of Mohamedanism by the sword, the Spanish Saracens of those days were a polite and contemplative race, their seminaries and universities were the most celebrated in the world, and Christian Europe was glad to profit by the unbelievers' tolerance, and glean in Spain those fruits of learning which in other European countries found but a barren soil [b]. Bacon is known to have travelled through Spain, and to have been well conversant with Arabian literature: the account of the composition of gunpowder he might have seen in an Arabian manuscript; this is at least as probable a supposition as that he saw the treatise of Marcus Græcus; indeed, there is in the Escurial Collection a treatise on gunpowder, written in 1249.

[a] Wilkinson on Engines of War, p. 143.
[b] Vide Thomson's History of Chemistry.

The earliest account which we have of gunpowder exists in a code of Gentoo laws, where it is mentioned as applied to fire-arms, and consequently, if the document be authentic, the most recondite of its properties, that of projecting weights, must have been well understood.

That particular code in which gunpowder and fire-arms are mentioned, is thought by many to have been coeval with the time of Moses! The notice occurs in the Sanskrit preface, translated at page 53, by Halhed. It is as follows: "The magistrate shall not make war with any deceitful machine, or with poisoned weapons, or with cannon and guns, or any kind of fire-arms; nor shall he slay in war a person born an eunuch, nor any person who putting his arms together supplicates for quarter, nor any person who has no means of escape." Referring to this document, Halhed observes, "It will no doubt strike the reader with wonder to find a prohibition of fire-arms in records of such unfathomable antiquity, and he will probably hence renew the suspicion, which has long been deemed absurd, that Alexander the Great did absolutely meet with some weapons of this kind in India, as a passage in Quintus Curtius seems to ascertain. Gunpowder has been known in China as well as in Hindostan, far beyond all periods of investigation. The word fire-arms is literally Sanscrit, Agnee-aster (agnyastra), a weapon of fire; they describe the first species of it to have been a kind of dart or arrow tipped with fire, and discharged upon the enemy from a bamboo. Among several extraordinary properties of this weapon, one was, that after it had taken its flight, it divided into several separate streams of flame, each of which took effect, and which, when once kindled, could not be extinguished [a]; but this kind of Agnee-aster is now lost. Cannon in the Sanscrit idiom is called Shĕt-aghnee, (sataghni), or the weapon that kills a hundred men at once, from shĕtĕ (sata) a hundred, and ghĕnĕh (hana) to kill, and the Pooran Shasters or histories ascribe the invention of these destructive engines to Bĕĕshŏŏkermā (Viswakerma) the artist, who is related to have forged all the weapons for the war which was maintained in the Suttee Jogue between Dewta and Ossoor, (Devata and Asura,) or the good and evil spirits, for the space of 100 years." [b]

Dutens, in the work referred to in page 344, has selected many passages from Greek and Latin authors, favourable to the opinion that gunpowder was known to the ancients. He mentions the attempt of Salmoneus to imitate thunder [c], of the Brahmins

[a] This description corresponds better with the nature of Greek fire than with that of gunpowder.

[b] Halhed, transl. Gentoo laws. Introduction, p. lii.

[c] Virg. Æneid, vi. 585. Themistius' Orat. xxvii. p. 337. Dutens also quotes, in support of this argument, Hyginus Fabul. 61, 650. Eustathius ad Odyss. Λ. 234, p. 1682, l. 1.

to do the same thing[a]; but his most remarkable quotation is from the life of *Apollonius Tyanæus*, written by Philostratus; showing that Alexander was prevented extending his conquests in India, because of the use of gunpowder, by a people called Oxydracæ.

The passage to which we have alluded is so curious, that we make no apology for giving it. "These truly wise men (the Oxydracæ) dwell between the rivers Hypharis and Ganges; their country Alexander never entered, deterred not by fear of the inhabitants, but as I suppose by religious motives, for had he passed the Hypharis, he might, doubtless, have made himself master of all the country round them; but their cities he never could have taken, though he had led a thousand as brave as Achilles, or three thousand such as Ajax, to the assault; for they come not out to the field to fight those who attack them; but these holy men, beloved by the gods, overthrew their enemies with tempests and thunderbolts shot from their walls. It is said that the Egyptian Hercules and Bacchus, when they overran India, invaded this people also, and having prepared warlike engines, attempted to conquer them; they in the mean time made no show of resistance, appearing perfectly quiet and secure, but upon the enemy's near approach they were repulsed with storms of lightning and thunderbolts hurled upon them from above."[b]

It is true Philostratus is not considered remarkable for veracity[c], and this assertion is not of a kind to be received without suspicion; but taking into consideration the records of Oriental History, the fact of pyrotechny having been cultivated from time immemorial in India and China, his assertion does not seem to us at all improbable. In India and many other parts of Asia, nitre occurs in great quantity spread over the surface of the earth: now suppose a fire lighted in such a spot, the most careless observer must have noticed the effect of the saltpetre in augmenting the flame; if then, attention having been directed to this phenomenon, charcoal and saltpetre had been mixed together purposely, gunpowder would have been formed. The third ingredient, sulphur, is not absolutely necessary, indeed very good gunpowder, *chemically speaking*, can be made without it. Sulphur, however, increases the plasticity of the mass, and better enables it to be made into, and to retain the form of grains.

Some persons refer us to Plutarch's life of Marcellus, and Vitruvius, as authorities in favour of the supposition that gunpowder was known to the famous Archimedes. All are ac-

[a] Valerius Flaccus, lib. i. 662. Dion. Cassius, Hist. Rom. in Caligul. p. 662, and Johannes Antiochinus Chromica apud Peirasciana Valesii. Paris, 1604, p. 804.

[b] Lib. ii. c. 14.

[c] Vide Lemprière's Class. Dict. art. Philostratus.

quainted with the talented aid which he lent to Hiero of Syracuse, in repelling the attacks of Marcellus:—how by volleys of enormous stone he destroyed, at a considerable distance from the walls, a stupendous machine of war, floating on eight galleys, and termed the Sambuca:—how he burned his opponents' ships by mirrors, hooked up their prows by cranes, and sank them stern foremost under the waves: in short, how he so terrified the enemy, that on seeing a rope or spar projecting from the wall, they cried out that Archimedes was levelling some machine at them. Amongst the engines which his fertile genius enabled him to construct, were some which are said to have gone off with a great noise, a description which it has been assumed does not apply to any then commonly in use, and that gunpowder seems indicated. To us this assumption does not appear to have much validity: we feel no difficulty in imagining the enormous engines used by Archimedes to have made *a great deal* of noise, even though their agency merely depended on bent springs and levers.

Those persons who are in favour of the opinion that gunpowder is a modern discovery, say that the historical records in which gunpowder is mentioned without ambiguity, such as the Gentoo codes, are of doubtful authenticity; that the narrative of Philostratus, besides its ambiguity of allusion, is vitiated by the character of the writer; that the traditions of other historians are obnoxious to one or both of the same remarks; that poetic allusions are not to be literally translated, and used as testimony in historic and scientific matters:—and lastly, they urge that if gunpowder and fire-arms had been known so early in the east, some of the conquering hordes who roamed from thence and devastated Europe, should have used such powerful auxiliaries to war: at least Mahomet should have been aware of this element of destruction, they say [a], and still more so Genghis Khan; yet such was not the case.

These arguments have great weight, but are not insuperable. We may answer, that the discovery of gunpowder, and the discovery of fire-arms, are separate questions; that gunpowder might easily have been made by a savage people, indeed, in countries where saltpetre occurs naturally, must have in a manner been formed by chance, whereas the manufacture of fire-arms involves a great amount of mechanical skill; hence missives urged by mechanical aid would long be thought superior to the first rude fire-arms, as in the present day the bow is preferred by the Chinese to the musket,—as it was in England in the reign of Henry VIII., and amongst the Turks not 200 years ago.

Thus, then, the dispute stands. We do not know who discovered this compound; certainly not the German Schwartz,

[a] Some believe Mahomet *was* aware of it. See page 345.

nor the English Bacon, nor Marcus Græcus either: we incline to the opinion that it has been known in Asia from time immemorial, and that its discovery might have originated in accident. Certain it is, however, that its first application to artillery in Europe, was about the beginning of the 14th century.

DISCOVERIES IN CHEMISTRY.

THE TRANSMUTATION AND NATURE OF CARBON, SILICON, AND NITROGEN.

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The great majority of chemists acknowledge the existence of some 55 simple or elementary substances;—these are declared to be simple, not in virtue of any test of simplicity which the chemist has discovered and applied to them, but solely because they resist the decomposing or modifying action of all the forces which are, or at least are known to be, at man's disposal. The chemist, as it were, begins with the globe itself, and breaks it down into some thousand organic and inorganic compounds; these, in their turn, he resolves into some hundred less complex substances; and the latter, last of all, into the 55 bodies which are called simple. Here his analysis, in the meanwhile, has ended; all the forces which are at his command, for the modification of matter, having been spent in vain on these refractory substances. The single and combined agencies of heat, light, electricity, magnetism, mechanical pressure, and the like, have been directed in innumerable ways against them. But they have emerged from every trial, except those we are soon to consider, without betraying any sign of non-simplicity, or unfolding, if they are compound, the hidden secret of their true nature.

On the negative evidence of this insusceptibility of decomposition, the residual undecomposed bodies have been termed simple or elementary: they are the visible elements out of which all things are made. It cannot be denied, however, that in the minds of many, the term "*simple*" has passed for something more than the expression of "*hitherto undecomposed*," and has been accepted as fully equivalent to essentially "*indecomponible*." But it would be doing injustice to the majority of chemists, to affirm that they have not employed the word "*elementary*" in its restricted and negative meaning, and have been willing to acknowledge the possible compositeness of all

* We have great satisfaction in presenting our readers with this memoir, abridged from the Edinburgh New Philosophical Journal. It is the substance of a lecture recently delivered on the compound nature of these hitherto supposed elementary bodies.

the so-called simple bodies. I refer to this the more particularly, that, in a curious volume recently published by Professor Low, exception has been taken to the maxim acknowledged among chemists, that a body should be considered simple till it can be shewn to be compound, and the opposite opinion advocated, "that a body is to be regarded as compound, when we are not able to prove it to be simple."*

It is not necessary, or, indeed, desirable, in the discussion of many chemical problems, that the possibility of the elementary bodies being simple should be considered. The study of most of the properties of the suite of oxides of a metal, or of a series of organic compounds, would not be facilitated, especially to a beginner, by shaking his faith in the stability and unchangeability of their simplest components. The elementary bodies stand in truth, in relation to all the more complex substances into whose composition they enter, like arithmetical ciphers, possessing in regard to all numbers higher than their own a fixed value, unalterable by any discovery which may be made concerning the lower figures which make them up. Silicon may be a simple body, as many believe, or a modification of carbon, as Dr. Brown supposes, or a compound of carbon, hydrogen, and oxygen, or of carbon and hydrogen, as Mr. Low thinks probable. But whichever of these it be, if any, is as indifferent to the chemist, while ascertaining the proportion in which it combines with oxygen to form silica, and a multitude of its other relations, as it was to the builder of an Egyptian pyramid, whether the bricks he made use of, so long as they possessed the proper shape and weight, and coherence, consisted of clay alone, or of clay mixed with sand, or of clay and sand mingled with straw.

The application of analysis to the reduction of the elementary bodies is easily understood. Without any addition to the resources, in the way of agent and instrument, we at present possess, it may suffice to produce more remarkable decompositions than we have yet seen it effect. If Mr. Rigg's and Mr. Knox's experiments are confirmed, it certainly will. Moreover, we may anticipate the discovery of novel agents, or of new powers in those we are familiar with, as we have recently become aware of the presence of marvellous modifying forces in the sunbeam, and in light and heat from other sources, of the existence of which we had scarcely a suspicion ten years ago. We may farther expect greatly to improve our instruments, and thereby to increase enormously our power over matter. Not to speak of what we should effect, could we realize certain improvements which theory indicates as possible in our voltaic batteries, the simple discovery of a substance which would resist the action of very high temperatures as

* An Inquiry into the nature of the Simple Bodies of Chemistry, by David Low, F.R.S.E., &c., p. 9.

effectually as platina and fire-clay do our ordinary furnace heats, would put in the chemist's hands a weapon for conquest of the highest value. Many of the bodies which appear at present, to use the quaint words of old Sir Thomas Browne, "to lie immortal in the arms of fire," might then be found susceptible of resolution into simpler forms of matter. The possibility of all this is so apparent, that it is needless to enlarge on it at greater length. Before passing from it, however, I would observe, that the attempts of chemists to decompose the so-called simple bodies, appear to me to have been hitherto too much directed against the naked elements themselves, and not upon them in a state of combination; and, further, to have too much implied an expectation, that their decomposition was to be brought about, by some successful violent effort to tear or force asunder their constituents. Hence, the uselessly large battery which Davy employed when he effected the decomposition of the alkalies. But the more we learn of molecular forces, the more we seem to become aware of the truth, that the simple reversal or neutralization of the affinities which bind the components of a body together, is all that is necessary to effect its decomposition; and that this may be as fully secured by the invisible action of a sunbeam, or the inappreciable influence of an electric current, as by the most gigantic galvanic battery, or a furnace heated seven times more than is wont.

Meanwhile, it remains to be acknowledged, that analysis hitherto has done nothing to lessen the number of elementary bodies; on the other hand, it has continually been adding to them. The ancients acknowledged but four,—air, earth, fire, and water; a later school had their three,—salt, sulphur, and mercury; and no class of chemists, down to the destruction of the Phlogiston School, acknowledged, so far as I am aware, as many as a dozen. Since the era of Lavoisier, we have been steadily increasing the list, till now we count 55. Sir H. Davy only altered the names of the elements with metallic bases, without abridging the roll by one; and since his death, several new bodies have been ranked among simple substances. The further result of analysis, whether with its present or with additional powers, may be of the same kind. The fifty-five elementary bodies may each be resolved into two, or three, or four, unlike, and for the time, indecomponible substances; so that the list of elements shall be doubled, tripled, or quadrupled. But though this may be the first effect, analogy and probability conspire unequivocally to assure us, that it will not be the ultimate result of a victorious analysis of matter. As we find the prevailing elements of the countless organic bodies we examine, to be the constantly recurring four, carbon, hydrogen, oxygen, and nitrogen; and as Davy found a common element, oxygen, in all the earths, so we may

expect, if the so-called elements are really compound, to find the same bodies present in many. We can suppose all the metals proving to be compounds in different proportions of but two: fluorine, chlorine, bromine, and iodine, in the same way reduced to two; carbon, boron, silicon, and the other groups of simple bodies, in like manner diminished to two. In this way, or in some other, we may resolve all the elementary bodies, as Mr. Low thinks we shall, into the two lowest on the atomic scale, carbon and hydrogen; or, descending further, identify them every one, as Mr. Rigg thinks we should, with hydrogen; or, in the lowest deep, finding a lower still, pass beyond even hydrogen to the long dreamed of Ὕλη πρωτη, the *materia prima*, or material substratum and essence of all things.

The application of synthesis to the reduction of the list of elementary bodies, is not so obvious as that of analysis, but may, on the whole, be made manifest enough. We can conceive the possibility of its being discovered, that two of the lower metals, such as lead and copper, when fused together, formed gold; and that, nevertheless, the compound should be of such a nature, as to resist the decomposing influence of every agent. In such a case, it would be possible to prove gold not to be a simple substance, by showing our ability to compound it out of lead and copper, though we might for ever remain unable to establish the same point analytically, by resolving it into these metals. Should such a synthetic demonstration of the compound nature of one of the elements ever be obtained, it would prepare us for attacking the problem of their true nature, by endeavouring to compound them out of each other. There is nothing, however, in the present state of chemistry to warrant the expectation of such a discovery being made; and it is not in this shape, but as one of the forms of the method of reduction by isomeric transmutation, that synthesis has been applied to the diminution of the list of elementary bodies.

For a long period after the publication of the Atomic Theory, it was universally believed that the same elements could combine in the same proportion to form only one compound, and that difference in physical properties, such as hardness, solubility, specific gravity, &c., was always occasioned by difference at least in the proportion of ingredients, and in most cases by difference also in their nature; and this is still acknowledged as true in regard to the majority of substances; water, *e. g.* is the only body containing oxygen and hydrogen, in the proportion of eight parts by weight of the former to one of the latter; common salt is the only substance, with thirty-five parts of chlorine to twenty-three of sodium, and so with other compounds. But within the last few years many bodies have been discovered containing the same elements, in the same proportion, and yet

differing in every physical and chemical property. A striking example of this may be found in a group of organic substances particularly referred to by Liebig in his Familiar Letters:—"A great class of bodies," says he, "known as the volatile oils, oil of turpentine, essence of lemons, oil of balsam of copaiba, oil of rosemary, of juniper, and many others, differing widely from each other in their odour, their medicinal effects, their boiling points, their specific gravity, &c., are exactly identical in composition; they contain carbon and hydrogen in the same proportions;"[a] viz., five atoms of carbon to four of hydrogen. Bodies which possess this peculiarity are termed, in relation to each other, *Isomeric* (from ισος, *equal*, and μερος, *part*,) which may be Englished equiproportional, and marks their possession of an equal proportion of the same elements. The unexpected discovery of this curious law, while it has shewn chemists that the greatest dissimilarity in the properties possessed by bodies may accompany the most perfect coincidence in proportional composition, has, at the same time, directly led to the conclusion, that the elementary bodies may form a group, or a series of groups, related to each other isomerically, or equiproportionally, as the volatile oils referred to, are. Who first detected the applicability of the law of Isomerism to the possible solution of the problem of the true nature of the chemical elements, I do not know; nor do I profess to offer any historical sketch of the progress of speculation on this subject. I need only mention, that three of our living chemists have published views on the possible Isomerism of the elementary bodies,—Professor Johnston[b] in 1837; Dr. Samuel Brown[c], and Professor Kane in 1141[d].

Dr. Brown's theory, which I consider first, as it is a scheme of transmutation by synthesis, is founded upon the existence of a class of isomeric bodies, in which, while the equiproportionality of identical elements occurs, the number of atoms combining to produce this, is different in each member of the group. Thus, there exists a series of compounds of carbon and hydrogen, containing these bodies in the proportion of atom to atom. This is satisfied in the lowest, which is termed *methylene*, by 2 atoms of carbon to 2 of hydrogen; in the next, *olefiant gas*, by 4 to 4; in the third, *oil gas*, by 8 to 8, and in a fourth, *cetene*, by 32 to 32. The volatile oils referred to previously, form, so far at least, a similar series; in them the elements are also carbon and hydrogen, in the proportion of five atoms of the former to four of the latter. In oil of citron

[a] Familiar Letters on Chemistry, by Justus Liebig, pp. 47, 48.

[b] Report of the Seventh Meeting of the British Association, pp. 163-215.

[c] Transactions of the Royal Society of Edinburgh, vol. xv. pp. 165 176, and 229-246.

[d] Elements of Chemistry, p. 377.

this is doubled, or we have C. 10, H. 8; in oil of cubebs tripled, or C. 15, H. 12; in turpentine quadrupled, or C. 20, H. 16.

Groups of isomeric bodies of this kind are supposed by Dr. Brown to be formed by successive duplications or doublings. The lowest member of the series, by combining with itself, produces a first multiple; this, by uniting with itself a second; that, by combining with itself a third; and so on *ad infinitum*. It is not essential, however, to the truth of this view, that a full series of duplicate multiples should be shewn to exist, provided no body is found to manifest an unequivocal departure from the rule: the gaps which occur in the known series may be filled up by future discoveries. Dr. Brown thinks he has established the truth of his view by experiment, in regard to the isomeric compounds of carbon and nitrogen, cyanogen and paracyanogen; the latter of which he believes to be produced by the former combining with itself. In like manner he represents the 55 so-called simple substances as a group, or a series of groups, of isomeric bodies, produced by the element of lowest atomic weight, (which may be the lowest at present known to us of *hydrogen*, or a lower and more truly elemental body,) forming successive combinations in the way already mentioned, so as to reach from, or through hydrogen, which we call 1, up to gold, which is 199 times higher. To prevent any mistake, I quote Dr. Brown's own words*: "This view of isomerism, and the relation of cyanogen to paracyanogen, is farther recommended by the consideration that it affords a practical foundation for a likely hypothesis of the constitution of the so-called chemical elements, and points out the way in which such a hypothesis may be either established or overthrown by experimental observation. Let it be supposed that several of the elemental groups are so many series of isomeric forms, and it is at once to be inferred that heat, electrolysis, and reagents, shall all be incapable of decomposing them, as has been found in the actual practice of the laboratories of modern Europe, by innumerable trials. If, to take one instance, sulphur (16 or 2) be an isomeric form of oxygen (8 or 1), which it as much resembles in chemical properties, as it is conformably contrasted with it in mechanical condition, it must be impossible to extract oxygen from it by any analytical force which has yet been discovered; and the only method in which it shall be possible to prove that such is the mutual relation of these two elements, shall be to have recourse to synthesis, and convert oxygen into sulphur. It is within the scope of this hypothesis that the various elements may be all isomeric forms of one truly elementary substance."

Dr. Brown's scheme of elementary reduction may be termed one by isomeric synthetic transmutation. You will observe,

* Trans. Royal Society, vol. xv. p. 176.

that he supposes transmutation to take place only by synthesis, and in one direction; so that an element possessing a certain atomic weight, may form, by uniting with itself another possessing a higher combining proportion; but the reverse cannot occur. Oxygen, which is eight, may double itself into sulphur, which is sixteen; but sulphur cannot halve itself into oxygen; carbon may quadruple itself into silicon, but silicon cannot quarter itself into carbon. All the other elements may be transmuted into gold, which has the highest atomic weight; for in this respect, Dr. Brown's views are strictly in accordance with those of the alchymists; but gold can be changed into none of them, and, if it suffer transmutation, must pass into some unknown new body possessing a higher combining proportion.

Mr. Johnston's views are founded on the existence of a class of isomeric bodies not taken into consideration in Dr. Brown's speculations. The members of certain isomeric groups possess not only the same proportion of elements, but likewise the same atomic weight. They are not multiples or submultiples of each other, like those already considered, but owe their difference in properties to the relative grouping of their molecules otherwise than by multiplication, or simple superaddition of the atoms on each other. We have a group of three such bodies in cyanuric acid, hydrated cyanic acid, and cyamelide, compounds of carbon, oxygen, and nitrogen. We have another in aldehyde, metaldehyde, and eltaldehyde; and a well-known pair in urea and cyanate of ammonia[a]. These isomerics possess the character of mutual inconvertibility: thus, in a group of three, which we may term A, B, C, A is convertible into B and C; B into A and C; C into A and B; and this without addition or subtraction of any of their constituent elements. Guided by these facts, Professor Johnston observes, that "the speculations of chemists in regard to the probable diminution of the number of received elementary bodies, have hitherto run only in the channel of decomposition. * * * * The idea of a possible *transformation* has hitherto hardly been thought of; and yet the doctrine of isomerism, rich already in its numerous discoveries, has shown that any number of the received elementary bodies *may* be made up of the same elements united in the same proportion."[b] After some incidental remarks, he continues, "It may be, however, that the patient study and pursuit of the kindred classes of phenomena we have been considering, shall in some brighter moment, show that substances considered elementary are yet *mutually convertible* without decomposition;" and, again, "It may be, indeed, that all our *supposed* elementary bodies are in *reality* such, and therefore wholly beyond the resolving energy of electricity,

[a] Liebig's Familiar Letters, pp. 49, 50.

[b] Report of British Association, vol. vi. p. 211.

or any other agent; and yet the study of their changes and reactions in the laboratory, in conformity, perhaps, with new views or modes of investigation, may at some future period, so enlarge our dominion over the molecules, as shall cause them, at our bidding, to assume this or that arrangement—to appear with the properties of chlorine or iodine, of cobalt or nickel, of rhodium, iridium, or osmium."[a] Professor Johnston's view, it will be observed, is a wider one than Dr. Brown's, inasmuch as it acknowledges a possible mutual convertibility of the elementary bodies; and therefore implies that transmutation may proceed in both directions of the atomic scale. Sulphur may become oxygen, as readily as oxygen sulphur; silicon carbon, as readily as carbon silicon; gold hydrogen, as hydrogen gold. Any one element, in short, may become any other, whatever be their atomic weights. This scheme might be termed, in opposition to Dr. Brown's, a method of elemental reduction by mutual isomeric transmutation.

Professor Kane's views are too slightly sketched, in his work on chemistry, to enable us to judge exactly in what way he expects the elements to prove isomeric, and they were certainly formed with a knowledge of what Professor Johnston had written on the subject. But he has indicated, in a way neither of the other chemists referred to have done, some remarkable relations between the atomic weights of certain of the metals, which would strikingly accord with either of their theories of elemental isomerism.

I do not offer any opinion as to the relative probability of Dr. Brown's and Professor Johnston's views; but it is impossible to help wishing that the latter chemist's scheme of elemental isomerism should prove the truer of the two. For Dr. Brown supplies us with but a one-edged weapon for conquering nature, while Professor Johnston puts in our hands a two-edged sword, smiting both ways, and increasing twofold our power over matter.

Meanwhile, Dr. Brown is the only chemist who has had faith and courage enough to test the reality of elemental isomerism, by endeavouring to transmute one of the elements into another. This, he believes, he has succeeded in doing in the case of carbon and silicon. His experiments have been made upon certain compounds of the former body with nitrogen, which he subjected to various modifying processes; one general principle, however, runs through them all, which may be explained in a few words. By a special process, instituted for the purpose, or as a product of a general process for transmutation, he obtained paracyanogen, a body consisting of carbon and nitrogen, in the proportion of twelve parts of the former

[a] Report of British Association, vol. vi. p. 212.

to fourteen (by weight) of the latter; or of two atoms of carbon to one of nitrogen. The atomic weight and exact constitution of this body are unknown, but Dr. Brown, as we have already seen, supposes it to be a duplication of cyanogen, and, therefore, to contain four atoms of carbon to two of nitrogen. When this body is treated in various ways, of which the simplest, and the only one we need consider, is that of heating it out of contact with air, alone, or in contact with substances (such as platina or carbonate of potass) having a strong attraction for silicon, its two atoms of nitrogen, according to Dr. Brown, pass away unchanged, and its four atoms of carbon combine together, and form silicon. To some, perhaps, the view intended, and its relation to the isomerism of confessedly compound bodies, will be clearer, if they suppose for the moment that carbon is a compound of two elements, which are united in it in certain proportions, and in the same ratio, but in a multiple four times higher in silicon.

The greater number of chemists refused to acknowledge that silicon was, or could be, produced from paracyanogen; and, joining issue with Dr. Brown on this point, offered no opinion on his theory of the origin of the silicon which appeared in his experiments. There was one chemist, however, Mr. G. J. Knox, who not only accepted Dr. Brown's statements as true, so far, at least, as the appearance of silicon was concerned, but advocated the probability of such an occurrence; on grounds, however, quite opposed to those Dr. Brown himself built upon. Mr. Knox's views are unfortunately not known to us fully, although it is more than a year since they were laid before the Royal Irish Academy. Owing to a peculiarity in the mode of publishing its transactions followed by that society, the paper has not yet been printed; and the only shape in which its contents have reached us is that of an imperfect and insufficient abstract in one of our own journals [a]. Mr. Knox conceives that the nitrogen of the paracyanogen, and not its carbon, is the source of the silicon which appeared in Dr. Brown's experiments. His own words are the following: after referring to certain experiments of Sir H. Davy, which seem to him to warrant the belief that nitrogen is a compound body, he says: "The latest experiments which bear upon this subject, and from which I received the idea which led me to this investigation, are those of Dr. Brown, 'upon the Conversion of Carbon into Silicon,'—an explanation of phenomena which appears to me most unreasonable, and contrary to all chemical analogy: while the supposition of the carbon having reduced the nitrogen, is not only a simple, but an unavoidable conclusion to arrive at, if nitrogen be a compound substance. To determine, by experiment, the correctness or incorrectness of this idea, it

[a] Chemical Gazette, September, 1843.

were only necessary to reduce nitrogen by some other substance than charcoal; and should silicon result from its decomposition, the problem might be considered to be solved."[*]

Mr. Knox then describes several experiments made with a compound of hydrogen, nitrogen, and potassium, heated in different ways with iron, in two of which silicon appeared, although no carbon was present. The compound Mr. Knox employed, he terms the "ammonia-nitruret of potassium," by which I understand him to signify the amidide of potassium (KNH^2) of other authors. He rejects one of the two experiments where silica appeared, as inconclusive as to its anomalous production; and draws from the whole the following conclusion: "From these experiments, together with those of Sir H. Davy mentioned above, one might infer that nitrogen is either a compound of silicon and hydrogen, or of silicon, hydrogen, and oxygen; to determine which synthetically, a current of dry muriatic acid was passed over siliciuret of potassium," and the resulting gases examined. These were found to contain a variable but marked proportion of nitrogen; so that, so far as can be judged from the imperfect account we possess, Mr. Knox seems to consider nitrogen a compound of silicon and hydrogen, and to believe that he formed it by the action of muriatic acid on siliciuret of potassium. He does not suppose, however, as some have imagined, that the nitrogen is *transmuted* into silicon; he believes that the former *yields*, but not that it *forms* the latter, in the way Dr. Brown supposes that carbon forms silicon. Silicon, according to Mr. Knox, *preexists* in nitrogen, along with hydrogen, or with hydrogen and oxygen, by combination with which it makes up the nitrogen. He supposes, accordingly, that, in Dr. Brown's experiments, the nitrogen was the source of the silicon, and that the carbon was useful only by combining with and removing the nonsiliceous element or elements of the nitrogen, and setting the silicon free; and he endeavours to establish this by shewing, that if the other conditions of Dr. Brown's experiments were retained, but the carbon replaced by a metal such as potassium, (or rather by potassium and iron,) the production of silicon went on as well as if carbon had been there. His view, therefore, has the advantage of explaining Dr. Brown's results as well as his own; whereas that gentleman's theory affords no explanation of Mr. Knox's experiments. The latter, moreover, professes not only to have decomposed nitrogen into silicon and hydrogen, but to have combined silicon and hydrogen into nitrogen; so that he offers both synthetic and analytic proof of the truth of his views. It is impossible, however, to judge of the value of Mr. Knox's experiments, till we see them reported in full; and there is a hesitation in his view of the

[*] Chemical Gazette, p. 574.

constitution of nitrogen, as to whether it contains oxygen or not, which might, and should have been removed by prolonged experiments, before he published on the question at all. Moreover, he determines nothing as to the quantitative constitution of nitrogen, which should surely have been the chief object of investigation, as soon as he saw reason to believe that nitrogen was not a simple body.

As to the relative probability of the rival theories of the origin of the silicon, which appeared when paracyanogen was subjected to Dr. Brown's processes, it is impossible at present to give a decision. I have repeated none of Mr. Knox's experiments, and it would be presumptuous in me to criticise his results; but I devoted the greater part of last winter, along with my friend, Mr. John Crombie Brown, to the repetition of Dr. S. Brown's processes for the transmutation of carbon into silicon, and I am free to offer an opinion on their value. Those who wish to know in detail the results my colleague and myself arrived at, will find them in the fifteenth volume of the Transactions of the Royal Society of Edinburgh [a]. Our general conclusions may be stated in a word.

We were able to confirm Dr. Brown's phenomenal results thus far, that we obtained silicon in several of our experiments, in circumstances which seemed, to myself at least, to preclude the possibility of its being derived as an impurity or accidental ingredient, from the vessels or materials, or reagents made use of. The quantity was always much less, than by Dr. Brown's hypothesis it should have been, and much less than he himself procured; in many experiments, morever, no silicon was obtained at all. So far, however, as this scanty and precarious appearance or production of silicon is concerned, we can authenticate Dr. Brown's results, but no further. Some misapprehension, I believe, exists on this subject, and I am anxious it should continue no longer. I took the most public opportunity that was open to me last autumn [b], of declaring my confident expectation, that a repetition of Dr. Brown's processes would establish the truth of his theory; and I owe it to myself, still more to those I induced by my representations to advocate his cause, but above all to the interests of science, which must be hindered in its progress by the confusion of doubtful with certain knowledge, to take as public an opportunity of saying that Dr. Brown's processes have not, in my hands, yielded proof of the transmutability of carbon into silicon. I have further come to the conclusion, that they are too imperfect to establish the truth of that proposition in the hands of any one; and that there exists at present no evidence, in the way of demonstra-

[a] Pages 547—559.

[b] In a letter to the Lord Provost of Edinburgh on Dr. Brown's claims to the Chair of Chemistry, which was printed and widely circulated, but not published.

tion by experiment, to satisfy a chemist, that carbon or any other element has ever suffered transmutation.

A peculiar difficulty attends the reception of the proposition, that carbon is transmutable into silicon; a difficulty which to many chemists seems insurmountable, and which has not been provided for by Dr. Brown in any of his papers, although he was aware of its existence. It results from the irreconcilability of the atomic weights of carbon and silicon, the former of which is 6, the latter 22.22. According to Dr. Brown, an atom of silicon consists of 4 atoms of carbon; but four times six is 24, not 22.22. If, therefore, transmutation by isomeric synthesis of carbon into silicon occur, it must, according to this view, be accompanied by a destruction of matter equal to the difference between 24 and 22.22; or, for every 24 parts by weight of carbon subjected to transmutation, only 22.22 of silicon would be obtained. I did not allow this difficulty to stand in the way of my repetition of the silicon experiments, as I saw a way of overcoming it. I shall mention what this was, without entering into any details in the way of vindication of its truth or probability. Let the received atomic weight of silicon, 22.22, be diminished by removal of the decimals, and made the round number 22. Such an alteration will, not improbably, be made by chemists, apart from all consideration of the question of transmutation. Then divide the received atom of carbon, 6, by 3, a liberty which would be conceded by many of my brethren, and it becomes 2; of which silicon is a multiple by the whole number 11. 11 atoms of carbon might, by synthetic transmutation, become 1 atom = 22 silicon, without any difficulty in the way of atomic weights.

From all that I have said, it will be manifest that no light task awaits those who propose to labour in the cause of transmutation. In the particular case of silicon, the question between Mr. Knox and Dr. Brown is one which can be settled only in the laboratory. It is possible that both of these gentlemen are right in their views. Nitrogen may be a compound of silicon and hydrogen, and silicon nevertheless, a compound or form of carbon. To do the subject justice, would require a careful repetition of all Dr. Brown's and all Mr. Knox's experiments, besides a lengthened series of independent researches, which would occupy at least six months of unremitting labour. The fact of an anomalous production of silicon is not beyond dispute; and till it is, the practical chemist cannot be expected even to consider the question of transmutation. Should the anomalous production of silicon, however, be fully confirmed, I think there are few who will not agree with me in wishing that, whatever be the fate of Mr. Knox's explanation, Dr. Brown's theory should prove true. It seems absurd to wish that a law of nature should prove one thing rather than another, as if the law, when discovered, could be other than of

God's making, and the best that can be. But what I mean is this: Mr. Knox's view, whilst it cuts off nitrogen from the list of simple bodies, reveals no general principle applicable to the reduction of the number of remaining elements. But if, with Dr. Brown, we could effect the transmutation of one of these, sooner or later we should assuredly succeed in effecting the transmutation of all. If we can find a key that will unlock in this way the intricacies of one group of elementary bodies, we may fully believe that the same instrument, or one fashioned like it, will open for us the mysteries of the rest.

In conclusion, it will be gathered from the brief and imperfect sketch I have offered, that the doctrine of Elemental Isomerism, and the transmutability of the elements, exists at present only as an unrealized idea, little, if at all, further advanced than it was in 1837, when first explicitly announced by Professor Johnston.

We are flung back, therefore, on the general analogies and probabilities that warrant the entertainment of such a doctrine; but these, I think, are neither slight in force nor scanty in number. All chemistry seems to me to point steadily and increasingly to the necessity of assuming, and, if possible, realizing such a law; and many of my brethren, I am certain, would agree with me in this. The scepticism so generally expressed as to the truth of Dr. Brown's views, was directed rather against the processes and experiments by which he professed to establish his doctrine, than against the doctrine itself; and so far as this implied a resolution to accept nothing but the most rigidly quantitative experiments, in proof of so revolutionary a proposition as that of transmutation, it was quite justifiable. The instrument *par excellence* of chemistry is the Balance; and every chemist must expect to have his discoveries literally and metaphorically weighed in it, and rejected if found wanting. The familiar Letters of Liebig, *e. g.* show that, although he unhesitatingly and too summarily condemns Dr. Brown's experiments, he willingly speculates on the light which Isomerism may throw on the true constitution of the elements.

RIVER PIERS.

The numerous, and frequently fatal, accidents which have occurred of late years at the different landing-places for steamboat passengers, on the banks of the Thames, have at last drawn public attention to the necessity of enforcing strong discipline in the management of them, and of exercising some adequate control over the construction of them. The Navigation Committee have approached this subject with zeal and determination; and have had submitted to their attention many plans well calculated to meet this expanding evil. It will be,

however, well to bear in mind that the subject has before now been allowed to repose from year to year; the diminution of traffic being too readily interpreted into a disappearance of the danger.

There are two ways of approaching this most desirable work of reformation. The one, by insisting authoritatively upon a satisfactory revision of the existing piers; by which, whatever tended to danger, or inconvenience little short of danger, should be removed, and safety and accommodation secured to the passengers;—the other, by vesting the entire control of the piers, as to locality, structure, and repairs, in the hands of those members of the municipal authorities within whose duties it could most aptly be placed. To the latter of these plans it may be objected that limits would be thereby set to the enterprise of the individuals or companies engaged in the steam-boat traffic; that vested interests are involved to a large amount, which must suffer deeply by so restrictive a system. To this we may answer, that the public have no other concern in the matter than that of ensuring their own safety and convenience, to which the pier proprietors seem to have been hitherto indifferent. So long as these two prime wants were attended to; so long as one could hope to set his foot upon the planks of the barges, or dummies, without the prospect of perforating them; so long as it was unnecessary for the hands to be called to the pumps every tide; so long as one felt secure that the contending advocates of rival boats would not make a drawn game of their struggle for patronage, by immersing their voyager in the mimic surge created by the impatient paddles; so long, perhaps, the public might be presumed to be contented with the rude attempts at accommodation which the landing-places of the most wealthy city in the world presented. But this inert security has passed away. Time and "certain politic rats" have gnawed away at the dummies—the hammer and nail knows no rest.—The arm of the pumper waxes faint—mayors and aldermen rise on the judgment seat, and pronounce emphatically that "something must be done."

This annual step having been made some months back, we were prepared to find that the customary slumber had come over the civic authorities. We were consequently gratified at perceiving in the papers at the beginning of October, an extract from a report of the Navigation Committee, in which it was stated that Mr. Walker had submitted a plan for erecting a pier at Blackfriars Bridge, available for the public service, at the *moderate cost of* £2,200. Now, save that Blackfriars Bridge was recently the scene of a most fatal accident, we know of no ground of preference upon which it can be deemed imperative to expend the sum of £2,200 upon its landing-place or pier. There are, between London Bridge and Westminster, at least ten piers; each of which, although not so dis-

tinguished by casualty, might put in claims to attention, upon some one or more of the grounds which we have just stated. Here then should be an outlay of £22,000; for at each landing-place it may be presumed the passengers have an equal right to protection. Is such an expenditure necessary? Has due caution been exercised in the selection of the proposed pier? We are assured by the report, that other plans ranged in their estimated cost between £4,000 and £10,000. Of this, from our experience in estimates, we have no doubt. But looking to the nature of the traffic, to its fluctuating character, to the parties engaged in it, can we say that an expenditure of such magnitude out of the civic funds would be justified? Let it be borne in mind that the *low charge* is the great temptation to the use of these steam-boats; their functions depend upon it. The rise of one penny per head, would diminish their power of competing with the land conveyances to an enormous extent. And yet, unless some capitation (the amount of which, if we may draw any inference from other corporation imposts, would not be "unassignably small") be laid on, how is the great outlay to be repaid? We are not blind to the extremely inconvenient and dangerous state of many of these piers. We are thankful to the municipal authorities for their interposition; which would, notwithstanding, have been more worthy of our thanks had it been exerted at a much earlier period. To return to the question of construction, proposed in the plans submitted to the Navigation Committee by Mr. Walker: we find that the least expensive, (£2,200,) and, as would appear to be implied by the terms of the report, the most eligible on the ground of absence of ornament, is to be erected on "open piles, on the north-west side of Blackfriars Bridge." We must confess that even the "not more than necessary impediment" to the navigation of the river secured, by the promise of "water-way under the pier, in spaces of not less than 30 feet, with a head-way at high water of not less than 8 feet," will not wholly reconcile us to the defects of a structure which does not appear to have needed the sanction of so eminent a name as Walker.

We could have conceived the practicability of many plans, each at a very much less cost; but it is not our place to attempt to interfere with the decision of the Court of Aldermen, by distracting their attention from the plan submitted, by intruding any one of our own upon them. We have some before us which, hereafter, we may give to the public for the sake of contrasting them with the "Specimen of a Method for communicating between Steam-boats and the Shore," adopted by the Navigation Committee. It should be remembered, that whatever may be done under such sanction as that of the above committee or court, not only should be best in point of workmanship, but from their supreme authority should afford all the conveniences which unlimited *choice of position* can confer

upon the plan. When we read, therefore, of "instructions to procure a plan for a pier from one of the piers of the bridge, or by a gallery outside the bridge," we can hardly concede our confidence to the plan, seeing the palpable inconveniences which would attend it, in respect of the *precipitous descent* of the stairs; or of the *great projection* into the river which will be inevitably necessary to avoid it. The plan laid before the Navigation Committee consists of two diverging flights of stairs, spreading over the arch, and descending from the level of the foot-way of the bridge upon two barges moored opposite the piers on each side of the staircase:—the barges projecting into the stream of the river, at least 120 feet. The descent by the stairs is broken about half-way down by a platform, resting upon large buttresses, from which the descent is continued bya moveable fretted inclined plane, which is made to adapt itself to the rise and fall of the tide. The design is neat; but it is open to both the objections which we have urged above, as well as to others. For instance, the bastions, or buttresses, standing out about 10 or 12 feet from the piers of the bridge, will create an additional eddy, dangerous to the passage of smaller craft; and the whole projecting range of the pier will be liable to constant concussion from the swinging round of the inert and unwieldy vessels engaged in the carrying trade of the river. We shall resume this subject at an early opportunity. In the mean time we invite attention to the threatened outlay, and its inevitable effects upon the very principle of the existence of steam-boat traffic on the river Thames, namely, its low price.

LUMINOUS APPEARANCE IN THE BAY OF BENGAL.

Ship Prince of Wales,
South Shields, Oct. 14, 1844.

The following is an account of the extraordinary luminous appearance seen in the Bay of Bengal. April 15th, at 10, A.M., left the floating-light vessel off the Sand Heads, (entrance of the River Hooghly,) had a fresh gale from south to south-south-east all day, the ship going on the larboard tack six and seven knots per hour, under reefed topsails. At 8 P.M., when the watches were relieved, preparations were made for tacking ship. The officer on the lee side of the poop observed a light on the lee bow, which was immediately reported to me. In a few seconds a faint light appeared a few feet above the surface of the sea, from the lee bow round to the weather quarter, apparently some miles in extent. The motion of the waves giving it a most extraordinary and beautiful appearance. I supposed it to be the phosphoric appearance which broken waves produce in the

tropics, and that it must be the broken water on the reefs off Point Palmyras. Had the helm put down and turned the ship round to the east-south-east, got a cast with the deep sea lead in stays, and had 22 fathoms depth of water, which placed the ship well off the land, and to windward of the reefs. I then had a good opportunity of seeing this extraordinary phenomenon. The light approached at times within a few fathoms of the ship, and when close to it, it had the appearance of a luminous vapour, and shot along the surface something similar to the aurora borealis, it then receded in the south-west quarter, and disappeared in twelve or fourteen minutes from being first observed.

At forty minutes past eight another one was seen right ahead, which remained stationary, and the ship passed through it, in fifteen minutes from being seen. It extended about a cable's length in a north and south line, and it took four minutes to pass through; the sea had a bright clear appearance when in it, and seemed like a clear highly polished plate of steel. Several large balls of brilliant light appeared under water, and several fathoms down, smaller ones were visible. The ship's rudder and after keel were clearly seen; and even the nail-heads in the copper perfectly distinct. It disappeared in twenty minutes after passing it, very gradually.

No alteration took place in the weather. The wind continued steady at south and south-south-east, a fresh gale all night, and had constant flashes of sheet lightning, without thunder from sunset.

It is a very common occurrence to see the broken waves of the sea luminous, and the wake or dead water which a ship leaves astern particularly so, and in calms with very heavy rain in the tropics, the drops falling in the sea cause the surface to emit faint luminous sparks, which are accounted for by the animalculæ on or near the surface; but I never saw any thing like the above phenomenon, except an accumulation of putrid matter (from the River Hooghly) on the surface, and being disturbed by fish passing through it, or probably some masses of fish spawn driven out from the entrance of the river, and putrified from the excessive heat and calm weather which had been prevalent for some time previous to my seeing it, with a shoal of fish passing through it, and disturbing it, which makes it emit a phosphoric light. I cannot account for it. I shall call on you on Wednesday, and give you any other explanation I can, if it be perfectly convenient to you.

I remain, dear Sir,

Yours very respectfully,

JOSEPH WILSON [*].

[*] For the above letter we are indebted to Dr. Clanny, of Sunderland, to whom it was addressed by Captain Wilson.

PATENTS.

No. III.

PAPERS ON THE PATENT LAWS AND INVENTIONS OF GREAT BRITAIN, AND ALL FOREIGN COUNTRIES GRANTING THE PRIVILEGES OF A BREVET.

COMMUNICATED BY MR. ALEXANDER PRINCE.

OFFICE FOR PATENTS, 14, LINCOLN'S INN FIELDS.

RETTIE'S PATENT

FOR IMPROVEMENTS IN COOKING APPARATUS.

Patent granted to ROBERT RETTIE, *of Gourock, in the county of Renfrew, in the kingdom of Scotland, Civil Engineer, for " Improvements in Gridirons, Frying-pans, and other Cooking Utensils, and Heating Apparatus."*—Sealed Feb. 24th, 1844.

THE specification declares the invention to consist in, or has reference to, the principles of construction and the modes of arrangement of the mechanical parts, and the several combinations thereof, as described, as regards the use of and the application of the same to the objects set forth in and by the title of the letters patent granted to him. The particular nature and intention of the said invention he declares to consist in the arrangement and construction of machines and apparatus, for the purpose of heating or warming the interior of dwelling houses, warehouses, and public buildings of whatsoever description, and in the arrangement and construction of certain vessels and utensils used in the operations and processes of domestic cookery; the same being set forth and described in and by his statement and specification thereof, reference being had to its accompanying drawings, by the letters and numeral figures marked thereon for the purpose of such reference. These illustrative drawings exhibit forms of construction and mechanical arrangements of considerable ingenuity, and highly useful character, but their number and their elaborate character render it impracticable to bring them satisfactorily within the prescribed limits of our present article.

One portion of the invention is an economic stove for the usual purposes of stoves, effecting by its arrangement and construction, and its action, a great economy in fuel or the combustible used in it, as well as a more equable and perfect distribution of heat, and that to a far greater distance from its source than stoves of ordinary construction and present use. It also

effects a complete correction and removal of the noxious effluvia produced by combustion, in stoves of ordinary form and construction. The peculiarity of arrangement and construction consists in the mode of admission for the air required to be heated for distribution, and in the arrangement of the pipes by which such distribution is performed, by which all the heat is taken from the main body before discharging the same into the chimney; and it is equally applicable to the operations of heating and of cooking.

Another description of stove formed on the same principles of construction as the economic stove just described is applied to the processes and operations of domestic cooking, and to the purposes of heating or warming the house or building in which it is placed, at one and the same time. This construction also applies to the purposes of a laundry or cooking stove. It is provided with a hot table and its usual appurtenances, and is applicable to the particular processes of stoving, steaming, and other purposes of that character, whilst at the same time it operates to distribute heat through the different apartments of the house or building in which it is placed.

The inventor makes a modification of the economic stove, adapted to the general purposes of heating required in vineries, hot and green houses, and all regular and scientific arrangements of buildings for horticultural purposes; and this construction is equally applicable to the warming and ventilating of the cabins and the different parts of the interior of ships and maritime vessels, where stoves of the ordinary construction cannot effectively or commodiously be applied.

Blocks of curved form cast in iron, or made of fire-brick, clay, or other incombustible and refractory substance, are applied to the purpose of curtailing or reducing the area or capacity of open fire-grates, and so to effect a reduction in the quantity of fuel consumed, and by consequence in the volume of smoke produced thereby. Small apertures are formed in such blocks for the purpose of admitting a free circulation of air about the sides and bottom of the stove, whence it issues into the open apartment. These blocks are made of various dimensions, forms, and proportions, to suit the varieties of fire-grates in which it may be desired to apply them.

He makes an utensil which he denominates a metallic scrubber, for the purpose of cleansing, by the process of scouring, of culinary utensils and apparatus. It is formed or composed of metallic wire, of thickness properly suited to the required size of the utensil itself, and the nature and material of the apparatus which it is intended to cleanse with it.

In its construction, he intermixes hemp or other materials, as bristles, or any vegetable or fibrous material of suitable character, with the wires, and the assemblage or compound so formed is bound firmly together.

Various ingenious modifications of cinder-boxes, coal-boxes, and cinder-shovels are made, which, by a simple construction, operate an economy in the consumption of fuel.

He has also organized new applications of earthenware, as moveable linings for culinary or other vessels formed of cast or wrought iron, or any of the metals.

A new form of sheet iron gridiron is constructed by striking it at one operation out of the metal plate by dies, or any of the well-known methods of effecting such operations, giving the required form; and this is formed either with plane or raised edges.

Other gridirons are formed of cast iron, and have fluted convex bars, and grooves or channels with interstitial openings, and projecting vertical ridges or bars, on which the substance to be exposed to the action of the fire is to be placed.

Specification drawn by Mr. Alexander Prince,
14, Lincoln's Inn Fields.

PARSONS'S PATENT

FOR MECHANICAL CHIMNEY SWEEPING.

Patent granted to John Parsons, *of Selwood Terrace, Brompton, in the county of Middlesex, for "certain Improvements in Machinery, or Apparatus for Cleansing or Sweepiny Chimneys or Flues."*—Sealed April 2, 1844.

In the year 1842, an act of the legislature was obtained, after several years of anxious and importunate application, for the relief of the children then constantly employed in the dangerous and demoralizing occupation of cleansing the chimneys of our dwelling houses. The distressing condition of so considerable a portion of our fellow-creatures called loudly for this legislative act. The nature of their employment not only in a great measure shut them out from society, and left them, depraved and neglected, to follow a course of crime in manhood, with which they had in too many instances become familiar in their youth; but, from the utter want of cleanliness to which it subjected them, gave use to numerous loathsome diseases, that, engrafted as it were on their physical constitution at an early age, clung to them in aggravated forms through the entire term of a wretched and painful existence. If to this too true portraiture of the case be added the general severity of treatment, and the positive ill-usage and cruelty to which they were frequently subjected, every one possessed of human kindness will readily allow that the poor and unfriended climbing chimney-sweeper had sufficient reasons to warrant reiterated and

earnest appeals to the common humanity of a British parliament on his behalf for a release from his disgraceful bondage.

The following clause of the act sufficiently explains its object:—"And be it enacted, That from and after the first day of July in the year one thousand eight hundred and forty-two, any person who shall compel, or knowingly allow any child or young person under the age of twenty-one years, to ascend or descend a chimney, or enter a flue, for the purpose of sweeping, cleaning, or coring the same, or for extinguishing fire therein, shall be liable to a penalty of not more than ten pounds or less than five pounds."

Many attempts have been made to construct machinery by which chimneys might be effectually cleansed, and for some time a simple contrivance was made use of, consisting merely of a radiating brush forming the head of the machine, fixed upon the extremity of a flexible cane, to which joint after joint was added, after the manner of a common fishing rod, in order to make the brush pass directly up the chimney. But in the great majority of cases, this head or brush failed entirely to produce the required results, for according to the usual constructions of chimneys, it was found that some parts required to be cleansed much more carefully than others, and it was evidently impossible that this could be done with the sweeping brush or head of simple form referred to. One thing became certain, that the cleansing and sweeping chimney flues must necessarily fall into other hands; and that instead of their being cleansed by boys and children entirely ignorant of any refined mechanical action or process, the work must be performed by mechanical men, and that with well-devised machinery, of simple arrangement and sound construction, easy of management, and efficient in its operation. These conditions of an interesting problem have given rise to many ingenious schemes for the purposes required, the latest of which, and in many respects, as we consider, the best, is the subject of the patent granted to this inventor.

The specification declares the invention to consist in, or have reference to the principles of construction, and the modes of arrangement of the mechanical parts, together with the combinations of the same, as therein described, as regards his application of the same to the object set forth by the title of the letters patent.

The particular nature and intention of the invention, together with the constructions, combinations and methods adopted and employed in practice, to embody and carry it into practical effect, are described as follows:—Firstly, In the construction and the mechanical arrangement of the parts of a compound sweeping brush, or brush-head, for the performance of the process of cleansing by sweeping chimney flues and passages of their deposited soot. Secondly, In the construction and the

mechanical arrangement of the parts of the supporting rods, shaft, or stem, on which the sweeping brush, or brush-head, is fixed for such purpose and application; and the mode of combining the brush-head and the shaft or stem together. Thirdly, In the construction and the mechanical arrangement of apparatus by which the shaft or stem, together with its attached brush-head, is in practice applied to the chimney flue, in order to effect the intended purposes with facility and due effect.

The sweeping brush, or brush-head, by which it is fixed to the upper extremity of the elevating shaft or rod by a screw ferrule attached to it. A flat and circular brush is arranged on a cylindrical block, and the upper face of this block is furnished with a projecting ring, around which are arranged eight small rollers, by which the passage of the rod is facilitated in turning acute corners or angles in a chimney flue, or in surmounting accidental obstacles. On the lower face of the same block, and below the brush, a similar arrangement of eight small rollers is made, of smaller dimensions, for the same end. The elevating rod is formed of whalebone, of malacca, of rattan, or any of the flexible canes; or of any substance possessing sufficient flexibility and toughness to bend as much as the free passage of the brush-head may require in sweeping chimney flues of the ordinary dimensions, and to recover its straight direction when released from such constraint. This degree of flexibility, toughness and strength, is obtained by constructing the centre of the rod of a flexible material as aforesaid, and covering it with metal wire wound spirally around it in close coils; and this, for further security, may be covered with gum caoutchouc, or other elastic substance. At the centre of a metal plate which covers the upper side of the block on which the circular brush is arranged, there is inserted in a screw socket a smaller rod of construction similar to the principal elevating rod already described; this carries, at its upper extremity, a small block, which is also furnished with eight small rollers. These rollers, together with the flexibility of the smaller rod, facilitate the passage of the entire brush-head.

The material of which the inventor constructs his circular brush, is whalebone, or cane split into such thicknesses as shall, according to the nature of the material, be required to afford the necessary flexibility. He also uses bass for the construction of such brushes, or hair of suitable strength, or any of the materials of which sweeping brushes are generally constructed, the material being varied to suit the circumstances of the chimney flue, as regards the dimensions of its horizontal section, and the nature of the surface to be swept.

The specification also describes another construction, or modification of the sweeping brush or brush-head, by which it has a power of self-adjustment, as regards its bearing and pressure against the sides of the chimney flue, and so affords it

a greater facility of advance in cases of intricacy of construction of the chimney flues, or frequent changes of direction in their passages.

The supporting rod or stem has a metal plate fixed transversely upon it; and there are ears projecting from the under side of the plate, carrying between each pair a small spindle, each such spindle forming a joint pin, on which a metal socket moves, the socket forming the setting of a portion of the required sweeping brush. Of these sockets, in practice he arranges four. Springs are attached by their lower ends to the principal supporting rod or stem, the upper and projecting ends acting against the under sides of the metal sockets, forming the sweeping brush. The action of the springs upon the metal sockets, by their tension, keeps the portions of the sweeping brush in their required horizontal position; but when the brush-head is thrust into the chimney flue, its pressure against the sides of the passage, throw them into an inclined position. When the brush-head is made to descend in the chimney flue, as in the action of forcible sweeping, they either remain in the horizontal position, or they assume an inclination upwards, as the angular quantity of such inclination being regulated by the width of the chimney flue. The inventor provides a guide socket or clip, which is made hollow through its entire length, allowing it to be set upon the principal supporting rod or stem of the machine, at any point at which it may be required. The supporting rod is clipped or inclosed within such guide sockets, at the required points, by opening them on their joints, there attaching them by tightening screws. Eight small rollers are set about the larger diameter of this socket, by the action of which the supporting rod is assisted in its passage over or against angles in the chimney-flue, or casual obstructions.

The patentee also describes an apparatus by the operation of which the sweeping brush or brush-head is applied to a chimney flue, and passed through its length by the supporting rod, in order to operate its sweeping or cleansing either during its ascending or descending passage. A cylinder or drum of wood, of about three feet in diameter, with radial arms, and its circumference or rim of about eight inches in width, about the rim a semi-cylindrical helical groove or hollow is formed of about one inch in diameter, this groove is continued about the circumference of the drum, making about ten revolutions thereon, and in this helical groove he applies the flexible supporting rod, composed as hereinbefore described; it is firmly attached by its lower extremity to the first entry or commencement of the helical groove of the drum, and on its upper extremity the brush-head is attached to it, as before described. The supporting rod thus applied to the drum, is held in contact with it, and is supported in its convolutions in the helical groove by metal springs applied to each turn of the helix on the drum, on

its front and hinder sides. A curved metal plate is applied to the hinder side of the drum, serving as a leading or guiding plane for the passage of the supporting rod into and through the lower part of the chimney flue or the fire-place. An iron spur wheel, of about eighteen inches in diameter, is set on the spindle or axis of the drum, and attached to it. A cross framing supports the spindle and the outer case of the drum. The spur wheel is driven by an iron pinion of about six inches in diameter, and this is actuated by manual labour applied to a winch. The machine is built on a bottom board or plate, which has small metal points for the purpose of keeping it steadily held to the floor of the apartment. There is an iron stay bar by which the machine is kept at the proper distance from the back of the chimney or fire-place.

A dial plate, fixed on the framework of the drum, registers the number of feet through which the sweeping brush is made to advance in the chimney flue, by an index or pointer fixed on the spindle of the drum. A smaller dial plate is placed above this, and is moved by the pointer of the larger dial acting on pins set upon the face of the dial, so that a fixed pointer on the upper dial indicates on its own dial the divisions or spaces marked by the larger dial, multiplied by ten. Thus the larger dial indicates by each of its divisions one foot, and by each entire revolution ten feet; the upper dial indicates by each of its divisions ten feet, and by each entire revolution one hundred feet. By this means the chimney flue may be gauged or measured before the operator commences the sweeping, and he is thereby informed with precision of the position or place of the sweeping brush in the chimney flue at any point of its position, and also when it has arrived at the top of the chimney flue and completed its required course.

Specification drawn by Mr. Alexander Prince,
14, Lincoln's Inn Fields.

COBBOLD'S TUBULAR LIFE PRESERVER,

By which Drowning is effectually prevented.

This most simple and inexpensive apparatus is constructed of separate or detached air cells or tubes, so arranged and adapted to the body as to render it incapable of sinking, and affording the greatest possible security to the swimmer. It may be instantaneously applied, giving perfect freedom to the limbs, and protecting the body from concussion against drift wreck, ice, or any other hard substance. It is greatly lighter and more durable than cork, and cannot, like that substance, become saturated with water, nor is it liable to be punctured or destroyed by friction, as is the case with all inflated and soft fabrics, being perfectly durable, and indestructible either by time or

climate. It may be said, with perfect propriety, that no person who values his life should go to sea without this complete safeguard and protection.

This invaluable preservative has been daily exhibited by the diver at the Polytechnie Institution, with the greatest possible success, for upwards of eighteen months, as appears by the following testimonials :—

"I, Edward McCarthy, diver at the Polytechnic Institution, Regent Street, London, do declare that I have regularly exhibited and worn Cobbold's Tubular Life Preserver, at the above Institution, for eighteen months last past. That I have invariably, and at all times, found it efficient for supporting me, however heavily clad, in the water, and that I consider it to be the most simple, most durable, and most efficient safeguard ever invented for the preservation of life from drowning."

"*August* 9, 1844."

"Royal Polytechnic Institution,
August 8, 1844.

"I hereby certify, that the Tubular Life Preserver, invented and patented by the Rev. Mr. Cobbold, which has been exhibited in this Institution for a year and a half, still retains its original buoyancy, and is, in my opinion, admirably adapted for efficiently supporting the human body in the water, and is, as a Life Preserver, perfect.

"Signed, R. I. Longbottom, Secretary."

The Tubular Life Preserver has also been satisfactorily tested by naval officers of the first distinction and experience at various sea ports, among others, by Captain Bullock, R. N., at the port of Ramsgate, where four of his crew, in presence of numerous spectators, plunged overboard heavily clad, and were fully supported on the water by the aid of this simple apparatus, without the necessity of making the slightest exertion, the experiment elicited the marked approbation of the gallant officer and the numerous persons who witnessed it. The life preserver has also attracted the attention of foreign powers, and after repeated successful experiments, has obtained unqualified praise from Humane Societies and various benevolent Institutions connected with the preservation of life.

The following panegyric, is translated from the report of the French Humane Society's proceedings at Boulogne; it shews in what high estimation this simple contrivance is held by our Continental neighbours on that perilous coast.

"We cannot close our Report without drawing the attention of our coadjutors and subscribers to an apparatus invented by the Rev. Mr. Cobbold, for aiding swimmers to support themselves in the water, and to remain for a long time without fatigue or danger in that element. Not only is it useful to

persons enjoying the delightful art of swimming, but any person clothed with this apparatus may plunge with impunity into the water; he cannot continue a moment immersed, but like a balloon, he will instantly rise to the surface, and may remain there for any length of time in a vertical and perfectly easy position till assistance can be rendered him. The experiments made under Mr. Cobbold's superintendence, in presence of the Committee, leave no room for doubt or question on this head. The apparatus is extremely simple, needs no preparation for its immediate application, and is therefore always available for use.

"The Humane Society is in possession of a complete model of this apparatus, which it owes to the kindness of Mr. Cobbold. The members of the Committee avail themselves of the present publication to congratulate that gentleman on the complete success of his happy invention, and to thank him for the communication he has made to our Humane Society at Boulogne."

CAPTAIN WARNER'S INVENTIONS.

In our discussions of Captain Warner's inventions, we have, we trust, neither exhibited levity nor acrimony. We have drawn all our reasonings and references from the correspondence which has passed between him and her Majesty's government, and from the present state of chemical science. If we have made use of any expressions which do not exactly correspond with any peculiar views Captain Warner entertains, we can conscientiously assert that they have not been intended to be offensive to him, and we regret that he should receive them in such a light. Captain Warner has disclaimed the wish to be considered as a scientific man, and therefore we presumed that he laid no pretension to assist in the advance of that branch of knowledge in which chemical compounds are classed. We have expressed our opinion that Captain Warner possesses a heated imagination. We have never denied that he is acquainted with some explosive power of considerable energy, but he has not brought forward proofs that he has tried experiments upon such a scale as to justify his sanguine assertions of the tremendous agency of his long range. We think that he deceives himself, and with the sway which enthusiasts so generally exercise upon the minds of the credulous, has persuaded others by the earnestness and sincerity of his assertions. But those whose duty it is calmly to weigh, and carefully to examine into new and startling views, must not mistake words for facts, and the opinions of others for proofs. It has been the modest perseverance with which men of genius have pursued their calm and unostentatious

way amidst neglect and difficulty, that has called forth the admiration of posterity; whilst those who have loudly and pertinaciously insisted upon their marvellous powers, have been consigned to that forgetfulness which is so obnoxious to discoverers. Nothing can better illustrate this fact than the fate of Winsor, who first introduced for the public utility the gas which illuminates our streets. Although a portion of Pall Mall was, many years before its general introduction, thus lighted, and the people at large had an opportunity of seeing with their own eyes the value of the invention, the announcement with which it was brought forward was so extravagant and incredible, that it was followed by distrust and ridicule. It was declared to be the means by which this country was to obtain enormous wealth, and to pay off its national debt. Its enthusiastic proposer, led himself away by the usefulness of the process, magnified its utility, and saw in it ends and aims which none but himself and the few upon whose minds he had produced an impression, could by possibility have dreamt of. We regret that we should be considered by Captain Warner as his scientific detractors, and with the assurance that the gentlemen who contributed the articles on his inventions are men that he himself would wish to be interested in his experiments, and who deserve not to be harshly classed amongst " the arrogant, the ignorant, or the interested," we submit a few observations by the practical chemist to whom we are indebted for the first paper, who has himself devoted time and labour to pursuits which constitute him a judge, and an authority upon whom we can rely.

The following is a letter which Captain Warner has, after a month's silence, addressed to the editor of the " Times."

Sir,—I have read in your paper this morning, some extracts from the Polytechnic Magazine for the present month, to which I should like, with your permission, to make a brief reply.

The writer's remarks may not damage me in the estimation of the judicious and thoughtful; but his assumptions of what I have done and said may, unless contradicted, excite a prejudice against me in the minds of many. Besides, I do not wish to be made responsible for absurdities I never uttered.

The writer in the Polytechnic Magazine, speculates on fulminating compounds, and assumes that I use them. On what authority does he attribute the use of any specific composition to me? My careful, and hitherto I am happy to say my successful, endeavour has been to conceal the agents I employ. The writer says, " When Captain Warner speaks of his six mile range, for which he required but a two pounder, he states a physical impossibility in the present state of chemical science; and Captain Warner is certainly not one in whom any reasonable hope could be indulged that by his knowledge any advance will be

made." Who the writer may be who treats me with such familiar contempt, I know not; but this I know, that I never spoke about sending a two-pound cannon ball six miles, nor said that any such flight could be accomplished by any ordnance or any agent of projection now in use. The writer classes me with theorists and enthusiasts, and laments that "scientific characters are debarred from the ground these enthusiasts (Normandy and Warner) claim as their own."

I never disparage any projector, and will not, therefore, write disrespectfully of the Duke of Normandy, Lord Dundonald, or Mr. Shrapnel, but I will observe, with reference to the first, that his failures have been numerous, which I would not name were they not also notorious, whereas I have never, in a single instance, failed in any experiment I have undertaken to perform; and as to the two latter, I have never heard of their having given any practical proof of their ability to make good their professions. I do not profess to be a "scientific character." I should make an indifferent lecturer on experimental philosophy; but I am a practical man, and have done what "scientific characters" have confidently pronounced to be impossible.

I rest my case upon facts, and not upon theories. I have already, on several occasions—on the last before 40,000 witnesses—demonstrated my control of explosive powers surpassing those hitherto employed, and I am prepared to show, by actual proof, my ability to make these agents of destruction available at a greater distance than any ordnance in her Majesty's service, if the government will only allow me.

I need not repeat in terms the challenge I have made, and which is sufficiently notorious, but I repeat my willingness to abide by it. Of fair discussion I shall never complain, and with the fate of almost every inventor before my eyes, it would be simple weakness on my part to complain that I share their common lot of being ridiculed by the arrogant, the ignorant, and the interested. When I remember what scientific characters have written in my own lifetime of steam and gas, and their applicabilities, and read of the portion of inventors in remoter times, I feel a sustaining confidence that whatever may be my peculiar fortune, my fame will survive that of my scientific detractors.

I am, Sir, your obedient and obliged servant,

S. A. Warner.

London, Oct. 17.

To free ourselves from the first charge of wilful misrepresentation, we have but to refer to the evidence given by Captain Warner before Sir Howard Douglas and Admiral Sir Byam Martin. In answer to a question, Where he had ever used or made trial

of his long range? he states, "The long range was tried in the presence of Sir R. Keats, at a place called Anholt, and my gunner, John Goldsack, with a two-pounder, at a distance of three miles," and "against the Bayonne Islands, off Vigo, at a distance of more than six miles." As on these occasions Captain Warner employed cannon, it is certainly one point gained, that he now admits its impossibility. In the paragraph in which he claims having demonstrated his control of explosive compounds surpassing those hitherto employed, Captain Warner displays a most surprising absence of knowledge of those means which chemists have now at command. To prove to him how easy it would be to repeat the experiment on which he so much relies, we will state one plan. Two shells of 68 lbs., the exact weight Captain Warner states his to be, filled with gunpowder, which would even give a greater explosive force than required, rendered like his "buoyant,"—like his "attached by a connecting line" fastened to stand the rocking of the waves, but which would give way before the force a vessel sailing over them would exert. Whilst giving way, the ends of the connecting lines being covered with a composition of chlorate of potash and sulphuret of antimony (the lucifer-match composition), should draw through a roughened tube placed in the interior of the shell, and thus fire the powder. The explosive force, checked on one side by the water, would concentrate its peculiar destructive power on the vessel; and this they could not fail to strike, pasing, as in the experiment at Brighton, along the tow-line. Shells thus prepared would follow closely the description Captain Warner gives before the commissioners of his invisible shells; no blow could fire them, and, like his, they would be dangerous only when connected with the line. To use his own words, "you may throw it about the deck as you will, without risk, when the connecting line is not attached. There is no danger until the connecting line is attached."

It is not urged that Captain Warner employs this plan, but he can from the above see with what ease and certainty the experiment could be repeated, if, as at Brighton, a line is to be attached to a vessel. The editor of the "Morning Post" objected to the experiment of Mr. Fulton being regarded in the same light as Captain Warner's, as the one took three days to do what the other performed in as many minutes. We were not aware of this. The explosion was instantaneous, and the vessel sank immediately. The editor should remember, that the difficulty of having no previous connexion with the vessel was fairly met. And though Fulton's experiment failed when tried in actual warfare, the officers who witnessed it as an experiment judged it worthy of a trial. Captain Warner is severe upon the Duke of Normandy, who failed so lamentably at Woolwich, and who, from the nature of his experiments, was clearly unacquainted with any of the laws

that govern projectiles; but Captain Warner should remember that some previous private experiments had convinced him, that he "could demonstrate a power quite as surpassing as Captain Warner's;" and a writer in the Advertiser newspaper referred to his experiments as confidently as Captain Warner's powerful advocate (the Times) now does, as decisive of the question. It was pointed out to the Duke of Normandy on the ground at Woolwich, that a plan so weak, so fragile, could not for a moment stand the shock of the gun; that his proposed rockets without sticks must move in eccentric courses: but the mastering these difficulties was, like Captain Warner's, "his secret,"—"he had discovered all." His failures are, as Captain Warner observes, notorious, but they failed at the high test to which government, for some perfectly inexplicable reason, submitted them; they failed practically. We admit they were ridiculous, "yet he had ruined himself by them;" like Captain Warner, he complains of the loss of fortune, the harassment of creditors, the pecuniary distress to which the pursuit has subjected him. We wish Captain Warner a better result; the power he claims, if it really exist, could be without doubt applied to mining and other purposes. We believe him to be mistaken in a branch of chemical science the most intricate and the most dangerous, in which the greatest skill in manipulation would be required. The loss of the valuable lives of Hennell and Allan, prove that even the knowledge is no guarantee for safety. That one utterly unknown as a chemist, repudiating even the title of "scientific," should have so wonderful a control over explosive powers, appear to us incredible, we repeat. Inventors jealous of their secrets, fearful lest every one should take some advantage, are thrown entirely on their own resources: blinded by their expectations, they see nothing but success; they judge for themselves where, their interests being concerned, they have so much need of the advice and judgment of others; nor is it till they have at a great expense secured the patent, that, consulting their friends, they find that their invention, probably known before and rejected, is valueless. As it is evident that in his experiment at Brighton, Capt. W. really persuaded himself he was performing something little short of a miracle, we are strengthened in the belief that the whole claim rests upon error. The rivals he has given birth to are certainly not formidable; two have been rash enough to publish their plans, and certainly wilder were never imagined; the long range is nothing to them. The first was a vessel made bomb-proof, to strike against a man-of-war, make a large opening, and sink her. The inventor was not aware that being bomb-proof would be useless in attacking a vessel of the line which would fire shot, the force of the blow from which, if they did not enter,—and shot-proof is an absurdity,—would be sufficient to sink her; and the three men the management of his vessel only required, would have

found it no particularly easy task to keep off the boats which even a frigate thus strangely attacked would probably launch; but the extreme difficulty of withdrawing a nail, could have shown the inventor that his apparatus having made the opening, it would have been impossible to have ever freed itself. The other plan is even wilder, being the alleged discovery of a Belgian chemist; a large rocket to run along the water, filled at the head with fulminate of mercury. Three things only require correction: at two miles, the rocket brigade would probably practise six months before hitting the vessel; rockets striking on the water sink almost immediately; and the fulminate of mercury's only recommendation would be its danger and expense. We will slightly enter upon this question, as there appears to be among the public a belief, that by the combination of gun and rocket some very great advance might be made. Congreve, the inventor, tried it without success; the stick, four to six feet long, is greatly in the way of loading. There were, however, some interesting trials at Portsmouth, where the troops were exercised upon the plan of firing rockets from a musket, great advantage having resulted from its accidental use this way, during an attack upon a pirate. The pirate's vessel was sailing in shallow water, and the frigate pursuing her launched out her boats to cut her out, or at least to stay her, till she could bring her guns to bear; but the pirate, who was well handled, was evidently too strong to be thus dealt with, and her escape seemed certain, when a marine, in the excitement of the moment, placed the rocket within his gun and fired it. The rocket started from the explosion of the cartridge, and assuming its own flight struck the rigging, &c., which became in one moment one sheet of flame. The pirates immediately struck. The practice on trial was, however, so bad, the impossibility of attaining even the slightest degree of accuracy so apparent, that the idea was abandoned. The fact is, that no one on firing a rocket can tell which way it will go. At a review on the Marshes at Woolwich, before the Queen Adelaide, one deviated more than 400 yards from the line of fire, and fractured a drummer boy's leg; and at another review, before Marshal Soult, one turned back, and struck close to his horse, most fortuately into a deep puddle. Every endeavour hitherto made to correct this has failed; they have been made to rotate like rifle balls; every kind of tube; vanes of every description, but without success. If they could be directed with even an approach to accuracy, they would indeed be a most formidable weapon. The French government has made some peculiarly interesting experiments off Brest on "percussion shells" against those fitted with a fusee; the result has been conclusive against any shell fitted with a fusee, they, after being kept in store for twelve months, were found uncertain.

REVIEWS.

A Chronological Introduction to the History of the Church. By the Rev. S. Jarvis, D.D., LL.D. W. J. Cleaver.

Dr. Samuel Jarvis was appointed, in the year 1838, the Historiographer of the Protestant Episcopal Church in the United States, with a view to his preparing from the most original sources now extant, a faithful ecclesiastical history from the time of the Apostles. In order to carry out the object thus proposed, Dr. Jarvis attempted to ascertain the exact time of the birth and death of our Saviour, and has with great research and careful examination of the best authorities, prosecuted his labours. He has exhibited accuracy and fidelity as an historian, the ripest judgment, and the clearest reasoning as a commentator upon the intricate authorities on which he has to build his foundation for inquiry. Chronology affords so many disputable points, such mazes of controversy, that it requires a mind of no ordinary cast to reconcile conflicting opinions as to epochs and dates. A knowledge of ancient languages, of astronomy, of religions, of inscriptions, of medals, of coins, of morals, and of customs, are often required to elucidate the difficulties which present themselves; and Dr. Jarvis has shewn himself an accomplished scholar, fully equal to the task committed to his charge. He has not addressed himself only to the learned, he has wisely written for the public, and has therefore given the testimony which has led him to form his conclusions. His work is divided into two parts, the first appertaining to ancient history in general, the second to the history of our Saviour in particular. He has commenced with the ancient methods of the computation of time, and connected them with those now in use. He first takes the Olympiads, as the earliest certain measure of time among profane historians. He shews that the Olympic Games were celebrated from the eleventh to the sixteenth of the first month after the summer solstice, giving his proofs from Pindar and his Scholiasts, and his inductions from Ptolemy. Diodorus Siculus, Thucydides, and Plato, bear him out, giving at the same time evidence of the manner in which the ancient Greeks reasoned on the computation of time. His next step is to give a correct list of the Olympiads; and this he is enabled to do by the recovery of the long lost part of the Chronicon of Eusebius, a copy of which had been preserved in the Armenian language. How singular does the reflection strike us that the preservation of the list of those who were victorious in the prize ring, should serve to elucidate the most important events of the Christian era. Having shown at what period of the solar year the games were celebrated, and an authentic register, our author proceeds to adjust the ancient

dates to the modern computation of time: this is done partly by historic testimony, partly by astronomical computation. The next subject of attention is the age of Rome. Here many difficulties present themselves from the difference of the testimony of historians. Through this confusion we are led by Dr. Jarvis; the carelessness or presumption of transcribers having added to the difficulties of elucidation. The Roman year, the Julian year, are fully explained; the ancient Egyptian year, the æra of Narbonassar, of Philip are explained; and a series of tables are given, shewing the accuracy of the computations of the several æras. With these dates are connected the historic events, the succession of the consuls, the reign of the Roman emperors to the period when Censorinus wrote in the year of the vulgar æra, 238 "the Birthday," which exhibits the greatest accuracy in the adjustment of dates.

Amongst the many important questions which are carefully examined in the course of his discussions are, the periods at which the temple of Janus was shut up by Augustus Cæsar, the year in which that emperor associated himself with Tiberius; the total eclipse of the sun in 4726, and the date of the death of Augustus. The second part of the work is devoted to the personal history of our Saviour; the reign of Herod the Great becomes the source of inquiry, because the date of his death must necessarily be the latest limit of that period within which the incarnation of our Saviour could have taken place, his history is therefore traced. As the death of Christ was a more remarkable event than his birth, its precise date is more easily to be ascertained, and the computation backward to his birth is a process of greater certainty: the limits of Pontius Pilate's administration, under whom he suffered, is the first step to be settled; the testimony of the Latin and of the Greek Church are then to be examined; then the true date of the passion of our Lord, the duration of his ministry, the time of his baptism, and lastly the day of his nativity, which he computes to be the 25th day of December, 4707, in the very same year in which Augustus shut the temple of Janus the third time, in token of universal peace. This is a brief outline of the subjects which have been so ably handled by Dr. Jarvis, and which clearly shews how laborious a task he has undertaken. The work is a foundation on which the Christian historian and theologian may build, for the materials are solid, and the work admirably executed.

Observations on the Sanatory Arrangements of Factories. By ROBERT RITCHIE, ESQ., F.R.S. John Weale.

THE ventilation of factories is the principal object of this work: its importance no one can doubt, and though there is little novelty in his remarks, they are forcibly delivered; he observes that not only inhalation of pure air is necessary for

health, but that the constant evaporation and absorption which go on through the cutaneous system, should engage attention; a combination of ventilation with warming should be managed for those engaged in factories; it is, however, too often overlooked. Mr. Ritchie proposes to warm the atmospheric air to a moderate temperature, before admission to all factories, by mild heating surfaces, and recommends a mechanical ventilator for pure air.

The Nervous System of the Human Body. By SIR CHARLES BELL. Renshaw, 356, Strand.

THIS volume is one of the utmost value to the physiologist. It is a collection of the papers read before the Royal Societies of London and Edinburgh, by one of the foremost men of the learned profession of the time just passing away—of one who assiduously devoted the highest powers of reasoning to the most important endowments of man, who studied with unwearied diligence that system which embraces the mind, the organs by which we perceive, and by which we will, and the highest adaptations of the nervous organization. Sir Charles Bell has unravelled many of the intricacies and difficulties which involved one department of anatomy, and has distinctly pointed out the functions of individual nerves which before were unknown. He has arranged his ideas in the simplest form, and has placed them in so simple and intelligible a form, that they are to be readily understood by the general reader. The papers before us being addressed to a body of scientific, but not of professional men, are necessarily written in plain language, and there are few technical terms introduced. In the first paper is to be found a lucid view of the structure and arrangement of the nerves of the animal frame: he has shewn that they are complex in proportion of the variety of their functions. Thus if an organ have but one endowment, however exquisite its sense or action may be, it has but one nerve, but if it have a double function, it is supplied with two. The leech or the worm have certain nerves in common with the human body, but neither has that complication of superadded nerves which the highly developed powers of the human body demand. He then proceeds to examine the original simple system which is general, and these have double roots; they are muscular nerves ordering the voluntary motions of the frame, and are the source of the common sensibility of the surfaces of the body. The superadded or irregular nerves then are explained by him. He then gives his views on the nerves of the face, shewing that two sets of nerves differ in structure, sensibility, and function, which had been previously considered similar; and here we have some masterly reasoning upon the fifth pair of nerves as those

by which sensation and mastication are performed, and upon the portio dura of the seventh pair as that by which muscular movement is given to the face, and assistance in the act of respiration. The chain of argument deduced from disease and from experiment carries with it irresistible weight. The nerves of respiration are next handled with all the acute and philosophic power which he possessed; he has led us out of a labyrinth which appeared inextricable, and has afforded us unequivocal proofs of the soundness of his judgment. He then assigns the uses of the various nerves which supply the eye, an apparatus of a most extraordinary character, exemplifying the wondrous works of nature, which has formed the most perfect optical instrument that imagination could conceive in so small an organ; the motion of the eyeball and of the lids is beautifully explained, and the connexion between the sense of vision and the exercise of the voluntary muscles of the eye admirably elucidated. There is a paper on the functions of some parts of the brain, and on the relations between the brain and nerves of motion and sensation which exhibits the minuteness of Sir Charles Bell's investigations, although it throws less light upon the nervous system than any other of the labours of that distinguished man. An appendix contains cases of deep interest, which illustrate the facts he has stated in his papers. We have likewise three papers upon the different subjects of his research, which are a summary of his views. A series of well arranged engravings illustrates the whole subject, and renders it perfectly intelligible; the fourth plate is especially well adapted; to explain to those who derive their anatomical knowledge from other sources than dissection. It is a complete key to the nervous system; whilst the second presents an excellent sketch of the respiratory system. Sir Charles Bell has given a curious history of the first dawnings upon his mind of the great truths he has been able to teach mankind. He had been engaged during the day in the dissection of the nerves of the jaw, the side of the neck, and the chest, which after a minute dissection presents such an intricate net-work, that it appears inextricable. On going into the country in the evening, he laid down upon paper what he had observed, on one sheet the nerves of double origin, on another the irregular nerves, and thus found the two systems of volition and sensation, and of respiration, which a few experiments confirmed. He was gradually led to unravel the confusion which had previously existed, and to advance the science of physiology in a department of the greatest value to man.

A Practical Treatise on Diseases of the Eye, by William Jeaffreson. Henry Renshaw.

This is the production of a man of observation, of prudence. and of humanity. The opinions are the result of twenty-five years of experience, during which singular opportunities were afforded him of studying, theoretically and practically, the nature and treatment of diseases of the eye. At the first impression, the announcement of having witnessed upwards of fifty thousand cases, would be considered an empty boast; but upon examination of Mr. Jeaffreson's field of exertion, we are led to acknowledge that there can be no reasen whatever to entertain a doubt upon the subject. He was nominated by the Honourable East India Company, surgeon oculist at Bombay, where, by the assistance of the court, he was enabled to establish an hospital, to which the natives of India and Persia flocked for relief. That he executed the task committed to his charge with talent and with fidelity, the volume before us carries with it internal evidence. From the peculiarities of the climate of India, the glare of the sun, the dust, the habits of the people, diseases of the eye are frequent, and often of an aggravated character; whilst in Egypt, where our author likewise sought opportunities of improvement, ophthalmia rages in its most virulent and destructive form. After the introductory chapter, in which Mr. Jeaffreson dwells upon the connexion that exists between local and constitutional disorder, and the dependence of one upon the other; he devotes three chapters to the consideration of the inflammatory affections of the eye; he describes symptoms with much judgment in their various stages, and then proceeds to his treatment, which is of a much milder character than that which has generally been advocated in this country. He is of opinion that the use of the lancet is far less frequently required in ophthalmic practice than either the works, the practice, or the general conversational opinions of practitioners would lead the uninitiated to suppose, whilst we possess means of controlling the active forms of inflammation that leave behind them less bad effect upon the system. The application of mercury to this branch of medical practice occupies a share of his consideration : he shews that whilst a careless use of this mineral may be most destructive, it is a valuable agent in skilful hands. Many useful remedies in the various states are clearly indicated: we regret that he did not farther inquire into a remedy that the natives of India are in the habit of using, a liquid that is dropped into the ear in cases of ophthalmia, by which a soothing influence is propagated to the eye, and which our author found in the course of his own practice highly efficacious. After an excellent chapter devoted to a consideration of the various appendages of the eye, and the affections to

which they are subject, we are led to the investigation of the diseases which spring from a morbid condition of the nerves on which vision depends, whether from functional derangement or organic lesion. Of that singular state in which some individuals are found who cannot distinguish colours, he gives a singular illustration. A gentleman, now of great eminence in a profession in Edinburgh, was originally apprenticed to a draper, but was compelled to relinquish this occupation from incapacity to distinguish colours, often exhibiting to the customers green articles for red, to the annoyance of his master, until upon careful inquiry his error of vision was discovered. The narratives he has furnished of extraordinary recovery from that total blindness which has been considered so thoroughly hopeless, must be cheering to those whose orbs appear "quenched in endless night." He holds forth encouragement for perseverance in the use of treatment which does not enfeeble the powers of the system; for he has seen many cases of recovery, either spontaneous or under the influence of powerful counter impressions, whether due to other diseases or medical treatment. He has ably described the peculiar characteristics of each separate form of cataract, and has shown how it is to be distinguished from affections which might be mistaken for it, and has compared the methods of operation with much skill. The last chapter embraces a view of the morbid growths which appear to arise out of constitutional states, and too often baffle the efforts of the skilful surgeon. The work concludes with somewhat brief notice of the aid which, by artificial means, may be given to vision. The rules for the preservation of the sight are good; and the method of judging of spectacles for indistinct sight is clearly pointed out. He judiciously intimates that the fashion of the present day of wearing a single eyeglass is prejudicial, as is likewise the use of small spectacles. He prefers preservers against wind and dust, of a blue tint, to those of a red. The numerous accidents which are often sustained during railway travelling, are to be guarded against by the employment of goggle spectacles. During the treatment of mechanical injuries he recommends great discretion in bleeding, which he thinks often paves the way to constitutional disasters and mischiefs which may easily be developed. The volume is well worthy perusal, and may be read by the public as well as by the profession, for it is not too technical nor too scientific for the ordinary class of readers.

Ambrose Ward; or, the Dissenter Reclaimed. Cleaver.

This is an interesting tale, during whose development religious truth and sound piety are well inculcated. A young rustic is accidentally led into an affray by his idle companions, who are engaged in poaching; he is wounded. From the cha-

racter of his associates, he is suspected of being engaged in this unlawful pursuit; this reflection aggravates his bodily suffering. During his confinement to bed he is under the care of a surgeon whose humanity and principles of religion lead him to assist the clergyman of the parish to wean him from dissenting principles, to which he was attached, and to render him a member of the Church of England. Success attends their united efforts; the young man is gradually led to walk in the right path, and eventually to become a pastor of the Church. He enters the ministry, and devotes himself to the responsibilities of the high office he has chosen. The character of the clergyman, Mr. Townsend, into whose fostering hands Ambrose Ward fortunately falls, is exquisitely pourtrayed; his doctrines are renovating, and breathe the purest spirit of truth. His explanations of many of the points in discussion at this moment are satisfactory, and evince a knowledge of sacred literature seldom possessed. There is an earnestness and virtuous feeling in this little volume which must render it acceptable to all those who wish to contemplate the road that leads to salvation.

Lacrymæ Ecclesiæ. By the Rev. George Wyatt. Cleaver.

This is a brief view of the persecutions which the clergy of England underwent during the struggles that occurred between the king and the parliament in the middle of the 17th century. We candidly confess we see no reason for the publication of this volume: it is not called for at the present moment. That during the fanatic delusions in which the puritanical party indulged, great wrongs were heaped upon the unoffending teachers of the Church of England, is unhappily too true; but such scenes have, unfortunately for the human race, occurred in different ages and different times. Sects and establishments have in turn become persecutors and persecuted; the dominant party has too generally retaliated for its sufferings, or has forgotten that moderation which belongs to true piety. The history of the church must be written for the purpose of ameliorating the condition of man, not to exasperate him against those who have tyrannized whilst power was in their hands. The work is well executed, and displays much reading and research.

De Porquet's German Trésor.

This will prove a useful assistant as well to the teacher as to the student of the German Language, and adds another valuable elementary work to those with which M. de Porquet has furnished the public.

The New Edinburgh Review. Hayward and Adams.

THIS new periodical promises well; it does not pretend to compete with its prototype, but at the same time has given us a series of well digested articles, which would not have disgraced its powerful competitor. "The true origin of the Gypsies" opposes the theories which have been started, in a cool and careful review of the differen topinions. "The advances since the peace" may also be mentioned as an indication that much thought has been bestowed upon the contributions which have appeared.

SCIENTIFIC MEMORANDA.

GAS FROM ANIMAL MATTER.—A process has been discovered by which animal matter can be converted into an inodorous gas, which burns with extreme brilliancy. It can be obtained at a very cheap rate, and may be rendered of great utility to domestic purposes, although it is not likely to supersede coal gas in lighting streets.

THE SMOKE PREVENTER.—Mr. Rettie's smoke preventer is a semi-circular plate of iron, with a flange at the top—the sides with passages for air; the plate is pierced with holes, while the one-third of the fire-grate underneath is open for a fresh current of air, which supplies an extra quantity of pure oxygen into the body of the coal, which consumes entirely the smoke and prevents any chimney which has a bad draught from polluting the apartment or destroying the furniture of the room or health of the inhabitants. It may be used in the most modern or antique grates, made either of cast-iron or fire-brick. The saving of fuel is also great; the combustion is complete, entirely preventing smoke.

THE EUXESIS.—This is a most ingenious article of domestic comfort. It completely supersedes the use of soap in shaving, it seems to have a peculiar effect on the skin, and is the only composition of this kind that we have yet met with that really deserves to be generally employed.

INDIA RUBBER PAVEMENT.—This invention promises to be of great utility in stables; it has been found to succeed remarkably well at Woolwich, where it was laid down in the stables by order of the Commissioners. It prevents the lodgement of the refuse of the horse, and thus the litter does not become imbued with those ingredients from which exhalations arise so hurtful to the animal.

THE HYDRAULIC RAILWAY.—Whether the powers of steam or of the atmosphere are likely to be superseded by the action of water, is a question which will probably soon be solved, as a company is to be formed to examine into its merits.

METEOROLOGICAL EPHEMERIS FOR 1845.—Mr. Doxat has published his annual work on the weather. From great attention paid to the subject, and a long and laborious comparison of recorded phenomena, he is led to anticipate that we shall gradually be enabled to predict with something like certainty the state of the weather. He has prefixed to his calculations a short view of his theory. He considers the state and condition of the atmosphere of our globe to be influenced by the degree of electricity present, and he considers the sun to be the source and centre of electricity, and the revolution of the earth in its orbit around that luminary as the first great cause of the variation in the amount of electricity supplied to the atmosphere. He calls upon the meteorologist to assist him in the development of his labours, and furnishes him with means for registering his observations. Whatever opinion may be formed of his theory, or of his predictions, his zeal and his anxiety for the attainment of truth deserve the approbation of all sensible men.

FRENCH NAVAL EXPERIMENTS.—Some experiments of a highly interesting nature (observes the *Constitutionnel*) took place some days ago in the port of Brest. Some percussion balls were tried, after having been laid by several years, in order to ascertain whether, after a prolonged exposure to the marine atmosphere, the permanent humidity of the shores was not capable of injuring them, inasmuch as it generally happens that the fusees of ordinary shells are completely useless for service after the expiration of one year. The results were highly satisfactory, and left no doubt as to the perfect conservation of the new projectiles. Thus M. le Commandant Billette will have conferred upon the navy the advantage of a new and terrible instrument of warfare. That officer has just adapted his system of percussion to hollow balls or shells destined for carronades of 30, 24, and 18; and thus all our cannons will henceforth be capable of expelling explosive projectiles. With the powerful destructive agents now in our power, battles will be of a very short duration, and victory will be obtained by the ship which shall first succeed in sending on board her adversary a small number of these explosive shells. But victory or defeat will be greatly decided by the accuracy of the aim, to which every attention should be paid. M. Billette has also proposed a new mode of firing pieces, more instantaneous than that now in use, and capable of affording the most accurate aim. New experiments are about to be made on board the different frigates now in port. If the hopes of the inventor are realized, a great step will have been gained in the science of naval gunnery; in fine, the problem of instantaneous ignition will be solved, and cannon-balls will fly with the velocity of thought.

These experiments must be of great interest to our govern-

ment, as they abruptly closed the trials with the "percussion shells," continuing those only dependent upon the "fusee"—the concussion; though as any chemist, or even a maker of fireworks could have foretold, such shells, depending upon powder exposed to the action of damp, &c., must always be uncertain. These decisive experiments of the French will, we trust, induce Sir George Murray to allow some further opportunities to those whose percussion shells appeared to require merely some slight modification to render them perfect, and with the practice so continually taking place on the marshes at Woolwich, some approach to the facilities afforded by the French authorities for the trial of experiments with projectiles, might be afforded by this Board.

Singular Effect of the Juxta-position of certain Colours under particular Circumstances.—At the late meeting of the British Association, Professor Wheatstone directed attention to a very curious phenomenon connected with the effect of certain colours upon the retina. A pattern worked in coloured worsteds, consisting of blue spots on a red ground, or red spots on a blue ground, being moved when illuminated by candle or lamplight, the spots appeared to have a very remarkable tremulous motion, perfectly independent of the ground. So strong is this illusion, that it is difficult at first not to believe that the spots are really detached from the ground, on which they appear thus strangely moving; and what renders it still more inexplicable is, that it does not succeed with other colours, nor can the effect be produced even with these colours, the blue and red, during daylight. It had been suggested by some who had previously seen the experiment, that the effect might be due to the alternation of light and shade occasioned by the ridged surface of the worsted worked pattern; but this was proved to be incorrect by the following decisive experiment:—The Professor prepared several patterns, painted with the same colours on a smooth surface of paper, and the effect was equally striking, nor did ruling the surface with crossed black lines appear to augment the effect. The Professor had made many trials of other colours, but the only colours by which he could obtain perfect success were red and blue, and red and green; the motion was not so apparent, and black spots on a white ground gave no result. The effect, therefore, could not depend upon the mere contrast of a bright and dark colour, nor on the contrast of complementary colours, but was intimately connected with the intensity of the light; if that were too strong, the apparent motion ceases, if too weak it equally disappears; and yet the absence of effect during daylight could not be thus accounted for, as the Professor observed that in a room carefully darkened, the effect was so trifling as to be doubtful, and however conducted, no effects at all approaching to those caused by candle or lamp light could be produced. The proper degree of illumi-

nation was easily to be ascertained by standing with the back towards the candle, holding the pattern at a short distance from the eye, and walking from the candle till the wished-for effect is seen. The experiment the Professor found to succeed equally well with candle, lamp, or gas light; nor did it matter whether the light came from one or from numerous points, though different patterns required a greater or less degree of brilliancy to produce the maximum effect. The Professor considered that this phenomenon depended in some way on the different durations of the luminous impressions of different colours, or tints varying in brightness, upon the retina, though he admitted the present impossibility of explaining why red and blue and red and green should alone produce the phenomena; and it was equally difficult to account for this strange phenomenon occurring only in candle or artificial lights. It is known that artificial light is yellower than daylight; but the attempt thus to account for the effect, would appear barred by an experiment in which the Professor passed the light through blue glass without diminishing the effect. And as red and green in daylight gives no result, the change of the blue into a green ground by the yellow flame could have no influence. This interesting experiment requiring no apparatus, and which every one can repeat, is very interesting, and may hereafter lead to some discovery connected with the at present obscure theory of colours.

GUANO.—In the *Agricultural Journal*, published by the Royal Society of Agriculture, will be found a valuable analysis of the excrementitious deposit of sea birds, which has been lately sent to us from the coasts of Peru, Bolivia, and Africa, and which has been hailed by the agriculturists of this country with so much satisfaction. Dr. Ure, to whom we are indebted for his valuable inquiries, has had frequent opportunities, during the last two years, of examining samples of every description. The following is the average result of Dr. Ure's analysis of genuine guano, in reference to its agricultural value.

1.	Azotized animal matter, including urate of ammonia, together capable of affording from eight to sixteen per cent. of ammonia by slow decomposition in the soil	50
2.	Water	11
3.	Phosphate of lime	25
4.	Phosphate of ammonia, oxalate of ammonia, ammonia, phosphate of magnesia, together containing from five to nine parts of ammonia	13
5.	Siliceous sand	1
		100

Very moist guano has in general more actual and less potential ammonia than the dry guano.

Electricity of the Earth. — MM. Linare and Palmeri have succeeded in obtaining an induced electrical current from the earth, sufficient to give a shock, decompose water, and to afford a spark. Their apparatus consists of hollow cylinders of iron, covered with seven superimposed coils of copper wire. These cylinders are rapidly rotated by means of wheel works, and the spark is produced by breaking contact with mercury, as in Mr. Clarke's electro-magnetic machine. The maximum of electric force is attained whenever the revolving system of cylinders arrives in the position of the dipping needle. The rotation should take place round a line perpendicular to the plane of the magnetic meridian.

South London Polytechnic Institution.—A prospectus has been forwarded to us of an Institution which its founders propose to establish on the site of Vauxhall Gardens. Whether such a locality be favourable or not, we cannot judge without an acquaintance with the habits and feelings of those who live in the vicinity. The greater the number of establishments for the promotion of science and art the better; therefore, it has our wishes for its success.

NEW MUSIC.

Pieta, Signore di me dolente. (Aria di Chiesa.) Composed by Stradella. Lonsdale, Old Bond Street.—This expressive air, composed by the celebrated Stradella, has been recently arranged by Mr. W. H. Callcott. It is a little antiquated in its treatment, but full of character, and in strict keeping with the sentiment of the words. We should like to hear Braham sing an English version of it: imparting to it that unrivalled expression which remains to him still in such vigour.

Già la sera in terra sparge. Arietta, Paroli di M. Maggioni; Musica da C. Pugni. *Farfalla leggera.* Ditto. Lonsdale, Bond Street.—These two compositions have much of that felicity of melody which appears to be the birthright of the Italian composer. Although there is little novelty in the thoughts or treatment, there is that suavity of expression which is sure to win the attention and induce agreeable sympathy. Signor Pugni is known to the musical *dilettanti* as the composer of some charming Ballet Music; the melodies in which are fully equalled by the compositions before us.

La Volante. Valse à deux tems.—*La Flèche et l'Eclair.* Ditto. Lonsdale, Bond Street.—The Valse, in its progress to perfection, has passed through several gradations of speed. At

its first introduction it was moderate and guarded in its gyrations: afterwards it became more *exigeante* in its demands upon the cerebral functions, and cycle upon epicycle whirled the devotees along faster than the revolving *dervishes* of the East. Strauss, Lacuna, and Labitzky, have adorned this class of music (the Valse) with strains as varied and piquant as ever waked an echo in the gladsome foot; still the busy fancy has urged the invention of the choregraphs beyond these limits, and the offspring of its impress is the "Valse à deux tems." Whatever may be the intrinsic merits of this dance, fashion has willed its popularity, and the dances at the head of our notice are among the most recent contributions to this "great necessity" as Coningsby would call it. Like the Polka, the *Valse à deux tems* must be practised under competent instruction; and the anomalies of the last season, (when people were at every turn endeavouring to prove by their motions that two were equal to three,) will be avoided by employing these tunes, appropriate to the rhythm of the step, instead of endeavouring to adopt the triple measure of the old Valse for that indicated by the very name of the newer dance.

POLKAS.—*The Real Irish Polkas: The Real Scotch Polkas.* By RICARDO LINTER. *The Original Polka Quadrilles.* By J. KRÖNIN. D'Almaine and Co., Soho Square.—We are always sorry when an idea, good in itself, is ridden to death, through an anxiety to catch the unthinking and silly, for to such only can the two sets of Polkas above mentioned make any successful appeal. The *reality* of *Irish* and *Scotch* Polkas is on a *par* with that of the celebrated Arabian fire-eaters, Muly, Sadi, and Hamet, recorded by the late admirable Charles Mathews. An imperative sense of public duty compels us, however reluctantly, to say that these Polkas (in which the old national airs are sadly distorted) are in no respect available for use; but of the two sets, the Scotch makes the nearest approach to utility. What would Mr. R. Linter say to a genuine *Polish* Scotch reel, or Irish jig?

Mr. Krönin's Polka Quadrilles (the 2nd is the eternal Cracoviak) have an average degree of merit, with but little of the Polka character. Simplicity of melody and peculiarity of accent, are essential to the Polka, in which dance a more strict union of music and motion is required than in the Quadrille.

The Daughters of Salem. Written by MRS. CRAWFORD. Composed by C. SLOMAN. D'Almaine and Co., Soho Square.—Smooth lines smoothly set to a melody partly derived from Bellini's 'Casta Diva,' of which, had the composer availed himself more, the result would have been better. There is too great a suspension of the sense, occasioned by a pause in this melody, (in the first stanza,) to which we point attention, in the hope that the composer will avoid such solecisms in his future

productions. Mrs. Crawford has composed the Babylonian Captivity of the Jews, with their final dispersion. This renders the song comprehensive, if not accurate. The title page, copied from a popular German lithographic print, is in much better taste than musical illustrations commonly exhibit.

"*Wake, Magdeline.*" The Poetry by Mrs. Crawford. Music by John Barnett. D'Almaine and Co.—This is a pleasing *Reveillée*, (not *Serenade*,) in Barnett's popular style. The vocal melody is sweet and sustained, mingling happily with the accompaniment, to which it is never sacrificed. The words are rather crowded in one or two places. We would suggest, in singing this charming little air, the substitution of the word 'rosy' for 'roseate.'

Reminiscences of Burns, (a Fantasia for the Piano-forte). Composed in honour of the Burns festival, and incribed to the sons of the Poet, by R. Linter. D'Almaine and Co.—In this brilliant and well arranged Fantasia, Mr. Linter has shewn both good taste and adequate skill, the deficiency of which it was our unpleasant duty to notice in his Scotch and Irish Polkas. The subjects familiar and dear to those acquainted with the home strains of Burns, are well chosen, and what is more to the purpose, in the midst of the treatment of the composer, are kept well before the attention of the hearer. On the other side of the Tweed, we hope that full recognition will await Mr. Linter's talents, which we are afraid to promise him on this, where so little of national feeling is allowed to exhibit itself towards musical art or artists.

"*O fairy Child.*" (Cavatina). Words by Wilson. Music by H. Hugh Pearson, Professor of Music in the University of Edinburgh. "*All my heart's thine own.*" Composed by Ditto. —In the course of our critical duties, we have frequent occasion to withhold the stern expression of our judgment, out of a tenderness for the interests, or a respect for the feelings, of those who may have either from necessity or by a pardonable vanity have rushed into print.

The young professor, seeking to eke out his income by the profits of the sale of his own productions, is to be regarded with indulgence; his misapprehensions of feeling, or perversions of taste, are to be treated solely as attaching to himself and his limited sphere of action. The productions of the amateur may be entitled to still greater indulgence, inasmuch as they are for the most part likely to influence none but the author. But the case is wholly changed when compositions, which would confer no creditable distinction upon the humblest aspirant to the honours of the lower of these classes, are paraded before the public with all the importance which an elevated position, like that

attained by Mr. Pearson, can confer upon their author. The first named of these airs no living soul *will* sing through a second time, the last they cannot *sing* even once; they may fumble out the notes, but no system of vocalization, with which we are acquainted, could convey expression to the barbarisms with which it is crowded. There are, however, in it (the latter) two phrases, the one a lame parody upon Weber's Polacca, in Der Freyschütz; the other, an appropriation of a passage in Haydn's Spirit Song, an air, to the disgrace of an age like our own, veïled, almost lost, in obscurity. It is easy to perceive that to Mr. Pearson, as to many others, Schubert and Mendelssohn have proved grievous stumbling blocks. But eccentricities, protected by the *prestige* of such names, meet with no recognition when imitated or caricatured by the nameless.

We have to acknowledge the receipt of a copy of Sir H. R. Bishop's edition of Beethoven's Mount of Olives, but we are compelled to defer until next month our notice of its merits.

THE SOCIETY OF BRITISH MUSICIANS.

THE first Soirée of this Society took place on Friday, the 18th ult. The programme of the performance contained:—A trio in D, Op. 70, of *Beethoven;* a quartet in A, by *C. Potter;* a sonata in F, pianoforte and violin, *C. E. Horsley;* and a quartet in D, No. 1. Op. 65, *Haydn.* The first was fairly played by Miss Day and Messrs. Gattie and Lucas. The young pianiste was somewhat below the exigencies of her subject. Potter's quartet is of long standing, having been written nearly 30 years. It is cast in the good mould of Mozart and Haydn, by the side of whose similar works it might fairly range itself. Horsley's sonata will add new laurels to his brow. It is replete with graceful melody, (so often wanting in the compositions of our most ingenious musicians,) abounds in those bold and animated passages which belong to this admirable young artist's style, and although breathing strongly of the inspiration of Mendelssohn, it possesses a marked vein of originality. The second movement was a lovely morsel. A Mr. Watson, of the Royal Academy, sustained the difficult violin part with great animation and purity of tone. His performance in each of the quartets and the trio, gave great promise of future excellence. The vocal portion of the concert calls for little notice. Misses Dolby and Lockey, and Mr. Burdini, sustained with their accustomed skill their respective portions. Purcell's Mad Bess, (sung by the latter lady,) should be placed under restraint and çommitted to a lasting séclusion. Mr. C. E. Stephens, who accompanied the songs, is as merciless as a locomotive train; he runs over everybody and every thing. The room was well attended, and we noticed among others

present, Sir H. R. Bishop, T. Cooke, and Benedict, whose presence could not but be flattering to the feelings of the Society, to which we most cordially desire success commensurate with its noble aspirations.

PRINCESS'S CONCERT ROOM, CASTLE STREET, OXFORD STREET.—
MISS CLARA SEYTON.

Young, graceful, lovely, versatile in genius, cultivated in expression, varied in accomplishments, this lady presents herself to the public as a lecturer on the drama, or what may now be more aptly termed dramatic literature. The grave disquisitions of Johnson, Malone, Stevens, Hazlitt, Schlegel, &c., fall from her fair lips with an air of apprehension which shews that she has made their sentiments completely her own. The difficulties of her course once overpassed—the misty and perilous passage of the antique and middle-age drama once accomplished, she rushes into the *examen* of our own elder writers, with an earnestness and discretion which startle the auditory. The attempt is arduous, and the performance laborious. She surmounts the difficulty and the toil with that delight which, in the words of her idol, " physics pain." As a reciter, Miss Seyton exhibits the fruits of a sound judgment. The deep well of feeling which springs up so unexpectedly in *Beatrice*, upon *Hero's* cruel repudiation, was beautifully pourtrayed, with all the yearning zeal of a young heart towards a beloved object, drooping under bitterest injury. No less successful were her lighter passages from the " Taming of the Shrew," and its modern counterpart, Tobin's " Honeymoon." Her most captivating, but not least truthful display, is in the part of *Rosalind*, with which she concludes her lecture; the current of which is interrupted from time to time by songs, chiefly from Shakespeare, to which she imparts, both in the music and in the sense of the words, that charm of expression which alone satisfies every hearer, and which wanting, none can be delighted. The songs introduced are as varied in character as the passages selected for recitation. We sincerely hope that an attempt like Miss Seyton's will be attended by the success which it so amply merits. We should prefer to her present form of lecture, in which there is much of dry detail, necessarily scanty, a disquisition upon Shakespeare's female characters, in which the varied and facile powers of the fair lecturer would find more fitting matter for exercise. We are glad to see that Miss Seyton has the patronage of one so refined in taste, and influential in the realms of literature, as the Lord Francis Egerton.

Since the above was written, Miss Seyton has produced a lecture upon English comic opera, the matter of which is hardly so well adapted for the display of her higher qualifications as that of her former exhibition. Her singing of the numerous songs introduced is always good; her feeling in close

accordance with her subject, and her vocalization characterized by great distinctness of utterance. Her lectures will form an attractive feature at all literary and scientific institutions, the directors of which already crowd round her with anxiety to secure her valuable services; so that it is impossible to apprise our readers where or when she may be met with. We only desire them to accept our assurance that her performance will most amply repay any pains they may incur in discovering the next scene of her appearance. Mr. Masters, who presides at the pianoforte, accompanies the songs with a skill which stamps him a genuine musician.

DRAMATIC LITERATURE.

The mathematician, the naturalist, or the classical scholar is ever engaged in a career where industrious emulation insures solid rewards, and honorary distinctions of the greatest estimation. The medal of an academy, or the prize of a university, awarded in succession to men of the brightest eminence, is eagerly contended for, and accepted with the highest satisfaction, and every succeeding year confers a greater lustre on the happy winner. The medal of the Royal Society, which has been gained by a Davy, a Wollaston, a Herschel, and a Young, is justly regarded as one of the highest meeds the man of science can receive, and to gain it is one of the most ardent efforts of his ambition, and the most valued compensation for his life of labour. Dramatic literature, on the other hand, stands in a very different position: subjected to the caprices of the censor and of fashion, the necessities of the manager and the waywardness of his audience, the pecuniary return for labour is as unremunerative as it is uncertain, and beyond the plaudits of the day, no mark of public approbation awaits successful achievements. A Bulwer, a Knowles, or a Talfourd has, indeed, the warm applause of his own day and the unfailing gratitude of posterity, but has he, like the man of science, any permanent token of his meritorious exertion? No: he is little encouraged, inadequately estimated, and when he ceases to write, ceases to interest his contemporaries. The actor feels still more the want of adequate sympathy: he may, like Macready, devote his life and energies to the restoration of classic works in the teeth of a cold uncaring public; he may, like Webster, offer the noblest stimulus to arouse the neglected votaries of the comic muse; a few public spirited individuals will thank him, a few discriminating critics will encourage the attempt, but there is no constituted academy to extend to him the laurel, or second by their influence his well-directed exertions. Then all parties—authors, actors and audience—have to suffer from the apathy, the inattention, the somnolence, which afflict every department of the drama; the author is unstimulated, the manager unsupported, the actor ill appre-

ciated, and on the very stage the throes of the drama, and its anility are made to furnish forth matter of entertainment for the auditors. Beyond the mere pecuniary reward, you must assure the author that there is some one to second him; you must give the manager a stimulus to elevated and intellectual exertion; if you wish the actor to be a man of education, you must make him such and treat him as such. What is the panacea? We propose none—but we are not to sit hopelessly by and do nothing. The geologist has his Geological Society, the writer has his Royal Society of Literature, the engineer his Institute, the most intellectual and the most unintellectual pursuits have their academies, why not the drama? Let it be so: but this is not to say that an academy can do every thing, it is not to suppose or affirm that an academy can create talent. It would be a delusion to suppose that it could, when all experience has proved to us the contrary. All the academies since the time of Michael Angelo and Raffaelle have failed to efface their genius, often to develope any genius at all, but we must not expect more than is reasonable. An academy can do something—not much it is true—but still it can do something, and it is just that something we want. It cannot create talent, we acknowledge, but it can call it forth, it can direct its exertions in the right path, and it can foster it; it can give its professors the benefits of mutual association, and it can maintain their position of respectability in society; it can encourage the young, it can do honour to the old. Let us look at the Royal Academy of Arts; has it not done these things? has it not given to the title of R.A. a high degree of consideration, and to the profession at large a prominent rank in public estimation? The man who degrades himself, who falls below the standard of his profession, is, in the inability to receive reward, punished with severity, and becomes an exemplary warning to others, while a regard for the opinions of his brethren and of the public, keeps the wayward and careless man in check. We are prepared to maintain that since the foundation of the Royal Academy, the artist is the object of more esteem, and is himself infinitely more deserving of esteem, as a member of a society, than he was a hundred years since. Then can we deny the benefits which have accrued to the veterinary profession from the institution of a college, and the premiums held out to respectability and intelligence? Yet what can we find more striking than the results produced on the surgical profession by the separation from the barbers, who had been linked to them, and an independent organization? The surgeon now almost jostles the physician from his seat. These are results which we conceive could be attained with the dramatic profession. We cannot make Shakspeares, God only can do that; we cannot do much more than make very respectable and estimable members of society; but let us do that. When, however, it is objected as argument on the negative side—

"the drama has repeatedly flourished, has more than once exhibited a galaxy of talent without an academy; the drama is, therefore, independent of such aid,—you had no academy in the days of Shakspeare, Massinger, Beaumont, Fletcher, Jonson, Forde, Peele, Green, Marloe, Field, Burbadge, Hemings, &c. You had no academy in the days of Congreve, Wycherley, Rowe, Addison, Vanbrugh, Lee, Cibber, Betterton, Oldfield, and Booth — you had no academy with Fielding, Colman, Murphy, Goldsmith, Garrick, Macklin, and Barry—you had no academy with Sheridan, Cumberland, Baillie, Kemble, Siddons, and Cooke." Granted; but when there is such a concentration of talent, there is virtually an academy created *de facto;* not in name an academy, but an academy *de facto* and *de jure*, and that is what we want to have in all times. Neither is the want of any organized institutions felt at such golden epochs: like a man with a colossal income, to whom economy is of little importance, but who feels its want in adversity, so we want no academies when we have our Buonarotti and our Raffaelles, our Shakspeares and our Jonsons, our Garricks and our Kembles: but it is when we have no such emulation arising from a preponderance of talent, that we want machinery to turn every thing to account. We have a great deal of talent in the country, we have a great deal of energy, a great deal of enterprise; but we are in that state it must be brought out. Talent will, to a certain extent, come forth of itself; but we want great epochs for its adequate developement, and we are therefore bound to believe that we can by exertion stimulate this developement. Phidias would have existed without Pericles, but it was the political and social influence of Pericles which brought him forth. So we see the political individual or political event accompanying the luminary of letters—Augustus, Virgil, and Horace, Elizabeth, Shakspeare, and Spenser, Cromwell and Milton, Louis Quatorze, Corneille, and Molière. Do not let us be deceived by expecting too much from an academy—by expecting what is beyond human means to effect; but do not let us neglect what is really useful and meritorious.

These are the reflections which have struck us on perusal of the laudable plan of the Society just formed for the Promotion of English Dramatic Literature. Emanating from men of elevated feelings and public spirit, though in infant condition it is supported by many of high consideration, great wealth, and distinguished talent, and will no doubt take a high and respectable position, under the best auspices, among the academic bodies of the metropolis; speedily receive the accession of many of those eminent for their dramatic works or performances, or for their encouragement of such laudable exertions. Constituted as such bodies usually are, the society will be governed by a council of dramatic authors, actors, and gentlemen of eminence and station; and its funds and exertions will be devoted to the

encouragement of dramatic literature and art. It would be premature, in the infancy of such a society, to speculate on what it can effect, or to promise more than the most moderate means can produce, but the design of the society seems calculated to attain its objects. Occasional meetings will be held, most probably in the concert rooms of the large theatres, when papers and communications will be read by eminent individuals, on the ancient drama, points of dramatic antiquity, Shakspearian researches, the biography of eminent dramatic authors and actors, the readings and emendations of our classic works and other similar features of interest. On these papers will be founded the regularly published transactions of the society, Annually, two gold medals, of the value of fifty guineas each, are to be awarded, one to a distinguished dramatic writer in the English language, regard being had to the moral of his works, and the purity of his duties; the other to some manager, actor, or actress, who shall have most contributed to the advancement of the English stage. The Americo-English, and all who speak our native language, and who are devoted to our national literature, will be recognised in the distribution of these prizes. Ultimately, by the award of other prizes, means will be adopted for rewarding commentators so laborious and assiduous as J. P. Collyer, Charles Knight, and Augustus William Schlegel.

When we look at the great good which has been effected in the promotion of Shakspearian literature only, by the Shakspeare Society, we must be convinced that, while on the one hand no prejudice can accrue from the Society for the Promotion of English Dramatic Literature, so on the other hand very great good must be effected. We are pleased with the exertion, and heartily wish it every success, and recommend such of our readers as may consider it an instrument in the promotion of that great engine of moral good, when properly directed, the Drama, to lose no time in giving it their co-operation and support.

THEATRES.

Our record of theatrical amusements must be brief, for the vast mass of matter which we have to lay before our readers, necessarily prevents our usual discussion of the amusements and novelties which our enlightened city presents to those who, after the toil and labours of the day, seek the recreation which gives a healthy tone and vigour to the mind, at other times occupied with its serious pursuits. Don Cæsar de Bazan has been in various forms presented at the different theatres, a melo-dramatic performance of considerable interest. Its hero, a roué, yet a man of feeling, and endowed with the highest qualities, which have been allowed to slumber during a

life of profligacy and recklessness, has found three representatives, the portraiture of each affording such shades of difference, as to render them objects of curiosity and interest. Wallack, Charles Matthews, and Webster, have each sustained with considerable reputation the part. At the Princess's, the drama is rendered more interesting by a longer developement of the incidents, whilst the acting of Celeste adds an additional charm to it at the Adelphi. The apology we have made for our brevity must be our excuse for not dwelling upon the high talents, and the graceful delineations of Madlle. Nau, at the Princess's. She has won golden opinions from all, and richly does she deserve them. Drury Lane is fast approaching to the state of the King's Theatre in point of performances, though not of fashion, to which it lays pretension, an ordonnance having been issued that none shall appear within the aristocratic circle, who do not dress in fashionable attire; whether this be more ridiculous or more presumptuous we shall not stay to enquire. The Keeleys still keep their agreeable little theatre alive with shouts of laughter, and go on prosperously and good humouredly. Shakspeare has taken refuge at Sadler's Wells, where Mrs. Warner and Phelps light the horizon with poetic fire, and dramatic brilliancy. The Royal Amphitheatre is preparing to attract, during the dreary nights of winter, the young and the happy with horsemanship, with splendid pageantry, and with displays of skill.

NOTICES TO CORRESPONDENTS.

The Self-registering Wind and Rain Gauge in our next.

Mr. Hine on the Drama is unavoidably postponed.

Atmospheric Railway, and

Kollman's Patents are under consideration.

On the Prevention of Drowning, received.

We have received several valuable Works, which will be reviewed as early as possible.

We beg to thank Dr. Clanny, of Sunderland, for his polite attention, and avail ourselves of it.

Professor Morse's Electro-Telegraph is but a modification of that of Professor Wheatstone's; it has, however, some improvements.

It will afford us much pleasure to be instrumental in making known to the public all new inventions and improvements. We shall, therefore, at all times, be ready to afford facilities for publication to those who may be desirous of bringing before the world the matured results of their inquiries into practical science.

GEOLOGY.

ON THE CONNEXION BETWEEN THE GEOLOGICAL STRUCTURE OF A COUNTRY AND ITS NATURAL SCENERY.

(Continued from p. 328.)

TRANSITION FORMATION.

THE only one of the transition rocks we shall mention is the Grauwacke. This is an abundant rock throughout Europe, and varies considerably in the character of its scenery. About the borders of England and Scotland, it gives the country a barren and monotonous aspect, consisting generally of a succession of rounded hills, covered with scanty herbage, and almost destitute of wood. In Germany, however, amongst the Hartz mountains, it presents some wild and savage scenes. And in Switzerland, it rises into mountains 10,000 feet high. There is a grand specimen of this formation in the Valorsine near the upper part of the valley of Chamouni.

SECONDARY FORMATION.

The secondary formation presents a great variety of scenery. It contains much which has been generally classed as landscape; and the greater part of that to which we apply the term *romantic*. We see it at times forming vast mountain chains, whose summits are clothed in perpetual snow; and at others it stretches into boundless plains, without one single undulation to relieve the uniformity of their surface. It is often hollowed out into lovely and fertile valleys, whilst in less favoured situations it expands into pathless deserts.

This great variety in external appearance arises from the circumstance, that the secondary formation comprehends many members widely differing from each other in constitution; but as we do not wish to occupy space by minute detail, we shall confine ourselves to giving an account of the more remarkable rocks it contains.

The most prominent of these is the *Alpine Limestone*, which exists in great abundance in many parts of Europe. The scenery of this formation is remarkable for its grandeur and magnificence. We find in it all varieties, from the stupendous mountain, towering to the height of 14,000 feet, down to the

gently undulating surface of a highly cultivated and ornamented country. It rises at times into mural precipices of great altitude; but in all its forms it is clothed with an abundance of vegetation, and differs in this respect remarkably from the two classes of rocks already mentioned. Its outline, though bold and commanding, is yet softer than theirs, and this arises from the nature of the rock, which yields more easily to the action of the weather, and has its sharp edges worn away. It is astonishing in what a variety of forms it appears. Sometimes we find the mountains cut down into precipices, which exhibit the stratified structure throughout; and in the neighbourhood of each other we find the strata of these mountains folded upon themselves, or dipping in every variety of direction. When seen from a distance, the alpine limestone exhibits the appearance of a number of vertical escarpments, facing different ways, and interspersed with cones almost resembling those of volcanoes: these cones, however, in the great majority of instances, are only end views of ridges. There is one peculiarity in limestone escarpments which we have frequently observed, namely, the existence of a talus, or sloping bank of debris of considerable height, between the foot of the precipice and the valley. Of this the Oberland of Berne, as seen from the Brünig, affords a very good example. The face of the escarpments also presents some peculiarities: the first of these, the existence of strata, has been already mentioned. The second is the rough and splintered appearance they generally exhibit; this arises from the nature of the fracture they take, and affords a striking contrast to the comparatively smooth surface of the primitive rocks. The colour of the limestone is also different: it is generally of a bluish cast, and its tints are much softer than those of earlier formations. The outline of its mountains is very striking. Their sides do not rise towards the summit in one inclined plane, as is generally the case with those already mentioned, but they present a succession of curves with their convexity downwards, and meeting so as to form ridges on the slope of the mountain, alternating with slight excavations. This peculiar structure has the effect of shading the mountain side in a very beautiful manner. The summits of the limestone formation have generally a conical appearance, as has been already mentioned, or they terminate in ridges. Sometimes we find them ending in a tall pillar of naked perpendicular rock; and of this there are many examples amongst the mountains that surround the Valais. This last characteristic, however, is most remarkably seen in the magnesian limestone of the Tyrol, which frequently presents the appearance of irregular square towers of rock; and in one instance a long ridge of this limestone looks like the jaw-bone of some gigantic animal.

The Oberland of Berne, perhaps, affords the finest specimens of the scenery of the alpine limestone in existence. It is there

seen in all its varieties, and under forms of unusual magnificence. This district of country is an elevated plateau, rising in the centre of the Alps and surrounded on all sides by precipices of immense altitude, which consist of limestone. One of its finest points of view is from the Brünig, a mountain to the north of the Oberland, and between them lies the deep and fertile valley of the Lower Hasli. Looking across this valley, we see the Oberland rising to the height of 12 or 1500 feet, and terminating in an escarpment many hundred feet high, beneath which, and betwixt it and the valley, is a talus of considerable height. This precipice of rock extends up and down the valley as far as the eye can reach, and is here and there diversified by waterfalls, which throw themselves down from the high land to join the river Aar. Beyond this range of rock are seen the gigantic mountains of the Grindlewald, belonging also to the same formation. Perhaps the finest specimen of the scenery, however, is found in the valley of Lauterbrunnen, a deep rocky ravine running up from the lake of Brientz into the Oberland.

The road winds along the side of a wild mountain torrent, and amongst sheer escarpments of limestone rock, the average height of which exceeds 1000 feet. The strata of these are ranged in all positions, and dip in almost every direction; but there is a keeping in all parts of the scenery that is quite wonderful. There is such a mixture of alpine sublimity, with the beauty of cultivated and fertile landscape, as is not met with almost anywhere besides. One great feature of the scenery of the alpine limestone is its stupendous cataracts with which this valley abounds. Some of them throw themselves over a precipice 1000 feet high, and are dashed into rain before reaching the ground. Of these the Staubbach is the most conspicuous; and the cascade of Terni amongst the limestone mountains of the Apennines is universally admitted to be one of the finest in the world. The caverns and excavations of this rock, although not in very immediate connexion with our subject, cannot be passed over in silence. The first of these exist wherever the formation is found; but those great excavations formed by the abrading influence of running water are not so frequent. The most remarkable with which we are acquainted, is the terrific gorge of the Rhine, in which lies the Via Mala, in the canton of Grisons. This cut has been effected by the water alone. It is spanned in one part by a single arch, and its depth at that point is about 400 feet, while the rocks below approach each other so closely in some places that the water is completely hidden by them. Other examples might be mentioned, but the one brought forward will be sufficient to show the nature of the appearances which these gorges present.

The mountains of the alpine limestone are of the most stupendous character. The Jungfrau in the Oberland which stands

at the head of all the Swiss mountains, is the finest example in Europe which it affords. This noble mountain consists of a vertical escarpment of blue limestone rising to the height of nearly 5000 feet, and over this lofty precipice rests a canopy of spotless snow, covering the whole of the uppermost part of the mountain, and ending in the beautiful white pic of the Silver Horn. There are many similar examples in the Oberland which need not be mentioned, but in considering all circumstances in connexion with this formation,—its gigantic mountains,—its lofty precipices,—its magnificent waterfalls, and that beautiful and fertile landscape which unites and harmonizes the whole, we are inclined to give it the preference over every other, as possessing the most romantic of all natural scenery.

The reason of the fertility of some limestone districts, is the facility with which the rock is broken down by the action of the weather, and the excellent soil it makes; and the probable cause of the sterility of others, is the presence of magnesia along with the lime, which is destructive of vegetable life.

Before quitting this part of the subject, we may just allude to the *Chalk Formation*, of which there are so many excellent examples in the south of England. We find it there forming gently rising hills inclosing broad and fertile valleys, and in some localities it exhibits cliffs of considerable altitude. The scenery is seldom bold, but often highly picturesque and beautiful. Its most striking mark is the white colour, which enters largely into the tints of the landscape.

The Sandstone is the next division of the secondary rocks requiring notice.

This is a very extensive formation in England, and gives a character to much of our landscape scenery. In most places in this country where the sandstone exists, art has done so much that it is difficult to recognise the natural appearance.

In many situations, however, where it has not been brought into cultivation, its aspect is bare and sterile. The general outline is flat or waving gently. It sometimes forms hills and ridges several hundred feet high, and not unfrequently contains striking views: we may instance the beautiful valley of Wharfdale, in Yorkshire, as an illustration.

In other parts of the world, the sandstone puts on appearances of a very different kind. We find it stretching out into boundless deserts, which have hardly ever been trodden by the foot of man. The Llanos of South America afford examples of this, where the flat surface of the country extends on every side to the horizon, and is nearly destitute of elevations even a few feet high.

The next members of the secondary series are the Trap Rocks, which, however, we shall treat of along with the igneous.

The Tertiary formations exhibit no very striking external

characteristics. They form plains and gently rising hills, and are remarkable for their white colour. Characteristic examples of them occur about Paris.

The Alluvial formations are rather to be considered as the covering of the others than as a distinct class in our present subject. Remarkable instances of these are to be seen in the plains of Lombardy, where the alluvium is so great in quantity as to exhibit a perfect flat even to the horizon. Its fertility is well known, and its general connexion with landscape scenery need not be pointed out here.

IGNEOUS FORMATIONS.

We come now to speak of those modifications of natural scenery which we find amongst the igneous formations, ancient and modern, and with these we shall conclude the subject. The ancient igneous formations are scattered in considerable masses over the world, but nowhere do we find so many splendid examples of them as within the British islands. The most remarkable rock of this series, in so far as its influence on natural scenery is concerned, is the Basalt, and, perhaps, the finest specimen of it in the world is the island of Staffa, amongst the Hebrides, which is so well known as hardly to require description, although a short outline appears needful for the illustration of our subject.

When seen at a distance, it appears like a small island, with black perpendicular sides: as we approach it, these become more lofty, and at length we discover that they consist of an assemblage of columns from 80 to 100 feet high. A nearer inspection discovers the entrance of a vast cavern, into whose gloomy abysses the waves of the Atlantic are incessantly pouring, and sending forth a hollow rumbling sound, like that of subterranean thunder.

The cave itself is difficult of access, and has to be reached by cautiously stepping down from one column to another to the water's edge. From this point, there is a pavement formed of six-sided sections of columns, by which the cavern may be entered.

The view from thence towards the water is very grand. The cavern is shaped liked the nave of a Gothic cathedral, and its sides are formed entirely of five and six-sided columns, springing out of the ocean, and rising overhead to the height of about 80 feet. Their structure is remarkable; they are as neatly smoothed, and their angles are as sharp and regular, as if they had been works of art instead of natural productions. They consist of segments built one over the other, like those of regular columns, but with this difference, that their joints are very accurately put together, and are an improvement on the artificial method of fitting, inasmuch as the lower segment has a portion

of a sphere on its upper surface which fits into a corresponding hollow in the one above it. This is an important part of the structure, for without it Staffa would have long since been washed away. The whole island consists of columnar basalt, and the sea about it has many fine specimens of the formation: some of these are bent, like the ribs of a ship, and from this circumstance have derived their names.

Another remarkable example of the basaltic formation is the Giant's Causeway, on the north coast of Ireland. It consists of an immense group of basaltic columns, extending into the sea for about 700 feet, and rising by successive stages to a height of about 200 feet. The columns are of all shapes, from three to nine sides, and are composed of segments like those of Staffa; their diameter varies from 16 to 20 inches, and they are from 20 to 45 feet in length; their general appearance is very much like those already described, with this difference, that at the Giant's Causeway a horizontal section of the formation is seen.

The cause of this remarkable structure in the basalt is supposed to be the tendency which this rock has to crystallize into regular prisms. This, however, is not always the case, for we sometimes find that the rock is thrust upwards from the soil, and forms rough escarpments of considerable height. The Castle Rock of Edinburgh affords a good example of this variety.

The *Greenstone* enters into the composition of some grand and imposing scenes. One of its chief characteristics is that of forming long ranges of mural precipices, and of these we have many fine illustrations in this country. The great crown of rock which is known under the name of Salisbury Crags, near Edinburgh, consists of it. But by far the noblest specimen exists on the coast of Antrim, in the north of Ireland. This is the bold promontory of Fairhead, which rises out of the ocean to a height of above 500 feet, and consists entirely of greenstone. This rock sometimes assumes the columnar appearance, and at Fairhead there are single columns from 20 to 30 feet in diameter, and nearly 200 feet high, entirely detached from the rest of the promontory.

The Porphyritic and Amygdaloidal rocks constitute, in this country, ranges of hills of considerable altitude, but nothing in comparison with what we find in other parts of the world. The chain of the Andes in South America contains a great quantity of these formations, which there constitute some of the highest mountains on the globe. The general outline of these ranges is somewhat peculiar. It consists of an elevated ridge, with, here and there, summits of a blunt conical shape, rising out of it. The Pentland Hills, and the Ochils in Scotland, afford good illustrations of this outline; and the Andes and Pentlands are said to resemble each other very closely. The cause of this peculiar form is supposed to be, that a series of rents has

at one time taken place in the strata, through which the melted rock has been poured upwards: it has spread itself on all sides, until a mount of considerable elevation has been formed, and when several of these have happened to be in the vicinity of each other, they have coalesced, and the spaces between them have become filled up, so as to elevate the whole mass above the surrounding plains; while the summits have risen to a greater altitude than the ridge itself, because these have been the last parts that have become consolidated, from the circumstance of their having been over the openings in the subjacent strata through which the melted rock has ascended. Such at least is the theory of this appearance.

The modern Igneous formations, or the *Volcanic*, as they are called, are peculiarly interesting, from their natural scenery, as well as for other reasons. Few are perhaps aware, that the whole of the country about Rome is of volcanic nature, and that the Eternal City itself is built upon the very site of an ancient volcano. The whole country for miles round is flat and barren, and the soil is of a brown red colour, and covered with a thin stratum of vegetation of a sombre green tint.

The Seven Hills consist of volcanic tufa, of which the celebrated Tarpeian rock affords a section about 40 feet high. Some facts also prove the occurrence of volcanic action even within the walls of Rome itself. We have all heard of the great rent in the Forum, into which Marcus Curtius threw himself; and even so late as the time of the Emperors an eruption occurred, during which flame issued from the ground, and destroyed the Temple of Peace, with all its treasures.

In the neighbourhood of Rome, there are two or three beautiful lakes, which occupy the craters of extinct volcanoes. The most remarkable of these are, the lake of Nemi, and the celebrated Alban lake, on the banks of which was founded Alba Longa. The latter is seated at the bottom of a crater, 200 or 300 feet deep, and about six miles in circumference. The slope of the crater is richly wooded down to the water's edge, and forms a scene of picturesque beauty that has few equals.

The whole Campagna di Roma bears the most evident marks of volcanic action, and presents many specimens of fine bold scenery. In many places, fumes of sulphur still taint the air, and there are two or three strongly impregnated sulphureous hot springs, which attest the former state of the country.

A still more striking combination of volcanic scenery exists around Naples. Along the bay, towards the west, there stretches a continuous line of volcanic hills, embosomed in which are several beautiful lakes, which also occupy the bottoms of extinct craters. Of these, the most remarkable is the classic lake Avernus, and the no less beautiful Lago D'Agnello, on the banks of which was situated, in former ages, the magnificent

villa of Lucullus. It may not be uninteresting to state that Baiæ, the most frequented of all the Roman watering places, was built along an elevated shore, which owed much of its beauty and diversity of scenery to its volcanic origin. Under the site of the palace of the Emperors, is still shewn a bath of salt water, nearly of the boiling heat, which is said to have belonged to the palace. This is situated several hundred feet within the bowels of a tufa hill.

The tufa formation in this district is of a pale fawn colour, and not very favourable to vegetation; hence the whole of this part of the coast of the bay of Naples has rather a bare appearance. Volcanic scenery, however, is nowhere to be seen in such perfection as around Vesuvius, which forms, perhaps, the most interesting object in the whole range of that beautiful landscape with which the country abounds. The ascent to its summit is generally made from the village of Resina, which lies between the base of the mountain and the sea. The road, if road it can be called, is a very irregular rocky path, which, leaving the upper end of the village, passes eastward between high walls of lava that have been built to inclose the vineyards which run up the slope of the mountain. On reaching the boundary of the vineyards, the path crosses the great lava current of 1822. The view from this point is most singular, and altogether unlike any thing to which we are accustomed in scenery. Every object in the picture, except the sky, is of a deep brown, approaching to black. There is no vegetation of any kind to give variety or covering to the ground, if we except a species of lichen, whose chief employment appears to be to break up the hard lava, to prepare it for future vegetation. On both hands there is a vast sloping expanse of black lava, rough and broken, by the manner of its progress down the mountain. This on the right hand is bounded by the sky, and on the left by the broken and reft summits of the Monte Somma. There is fully two miles in breadth of this rocky foreground, and right in the centre of the view rises the black cone of Vesuvius, rolling its vast cloud of smoke into the air. The cone must be nearly 3000 feet high above this spot, and forms a grand and imposing part of the scene. We resume our path, which turns here towards the left, and reach the hermitage of the Somma, by a path cut out of the loose tufa rock, of which the lower part of the mount consists. Here there are some trees, but vegetation is stinted, and soon disappears entirely. At some distance beyond the hermitage, there is a little hill of black lava, from which there is a noble view of the mountain. In front rises the stupendous cone, consisting entirely of black scoriæ and ashes, with here and there a projecting ridge of lava, or a huge mass of ejected rock lying on its steep side; and behind us the precipitous and broken surface of the Monte Somma, bearing everywhere the strongest manifestations of

those fearful and destructive forces that have spent themselves upon it. It is cracked and shivered into an innumerable multitude of fragments, piled upon each other rather than constituting one mass; and it is in many places traversed by thick dikes of lava, which appear like contorted lines on its surface. The most remarkable objects which it exhibits are, the sections of craters of some older eruptions, which are distinctly visible, and appear like funnels with the small ends downwards.

The ascent of the cone is more difficult than might at first be imagined, and is at present effected over the lava stream which flowed from the mountain in 1839. On arriving at the summit, two objects immediately absorb all attention. The glorious view of the bay of Naples, with its beautiful shores, which are stretched out like a map at our feet, and the crater of the mountain on the brink of which we stand.

It does not enter into our design to describe the phenomena of volcanic action, but it may complete this sketch of volcanic scenery to give a very brief outline of the state of the crater as it at present exists, or as it did exist very recently. The crater is a vast circular pit, with nearly perpendicular walls, about two miles in circumference and 200 feet deep. Its bottom consists of waves of black lava or scoriæ, and in the centre of it rises a cone of scoriæ to the height of 150 or 200 feet. This cone has two openings on its summit, from which a continual emission of white vapour takes place; and about once in five minutes, there is an explosion heard far within the mountain, and which is followed in a few seconds by the ejection of a vast quantity of fumes and fragments of melted lava, which, by daylight, have the colour of blood, but after sunset, are of a dazzling white heat, while the vapour is brilliantly illuminated so as to appear like flame. Lava escapes in abundance from the base of the cone, and flows beneath the hardened crust which forms the floor of the crater. Occasionally, however, it melts its way through, and flows in a broad stream over the surface, which in its turn becomes hardened by cooling, and a fresh eruption takes place elsewhere. In this manner the whole crater will eventually be filled up, and when this occurs, an eruption on a great scale may be expected.

The volcanic scenery about Mount Etna is also very striking, and might have been described had our space permitted. We shall, however, simply state, that its general character is very similar to that of Vesuvius. One peculiarity of Etna consists in the multitude of extinct volcanic hills which have sprung out of its sides; there are about 100 of these on different parts of the mountain, and they present an extraordinary feature in the landscape. The ground about them is covered with volcanic ashes, and nearly destitute of vegetation; whilst, in many instances, these hills are covered with a profuse and brilliant

foliage, and appear like oases in the midst of a desert. Another striking feature of Etna is its gigantic size; it rises to an altitude of 11,000 feet above the level of the sea, and has its summit covered with perpetual snow. Some idea may be formed of its dimensions, from the fact, that the ascent to the summit is 30 miles in length.

Volcanic scenery must be viewed during the time of eruption in order to get a true estimate of its nature. Sir William Hamilton has seen Vesuvius project a stream of melted lava to the height of 10,000 feet perpendicular above the summit of the mountain, and appearances such as these must be seen to be at all appreciated.

In all modern volcanic districts, there is a remarkable ruggedness of outline, occasioned by lava currents, or the effect of earthquakes. On the south coast of Italy, the country appears as if it had been shaken to fragments; the hills are rent into detached masses, and all bear the most intense evidence of subterranean force.

From the brief sketch which the preceding pages contain, it will be perceived, that a correct knowledge of the kind of causes which influence the features of the landscape of any country, is a matter of great importance, particularly to the geologist and artist. The former would be enabled by it to pronounce with tolerable certainty on the structure of a country on whose shores he may never have landed; and the latter, to depict with precision the characteristics of the various formations which enter into the composition of landscape. To every lover of nature, it opens up fresh sources of enjoyment, by attaching a deeper interest to the scenes which he visits, and by shewing that the beauties of inanimate creation are as much the result of design, as the most elaborate of living organisms.

THE PARLBY AND CONGREVE ROCKETS.

TO THE EDITOR OF THE POLYTECHNIC REVIEW.

SIR,—I have perused with considerable interest and attention the papers which have lately appeared in several numbers of your excellent Magazine, connected with the subject of "explosive compounds," Captain Warner's experiments, &c.; and as I have had for many years considerable practical experience in these matters, perhaps you will allow me to occupy a very small space in an ensuing number.

Before proceeding to other matters, I shall venture to oppose an assertion in one of these papers of September last, page 203, viz., "rockets of 100 lbs. weight are found not to move one yard."

Now, Sir, I beg to state that I have made and fired many rockets of greater weight than 100 lbs., up to 170 lbs.[a], upon my own principle of construction, and with very satisfactory ranges; and upon the principles on which I construct my rocket, I can state that there is hardly a limit to the size, except the difficulty and expense of the necessary mechanical apparatus, to which rockets may be made.

But, Sir, to show that much larger rockets than you suppose have been made with success as to flight, &c., I will merely quote two extracts from a book in almost every large library, "Colonel Symes's Embassy to Ava." The writer, alluding to a display of fireworks, (page 173, quarto edition,) states as follows:

"The display of rockets was strikingly grand, but nothing else merited attention. The cylinders of the rockets were trunks of trees hollowed out, many of them from two to three feet in circumference; these were bound by strong ligatures to thick bamboos, eighteen or twenty feet in length, *they rose to a great height*, and on descending, emitted various appearances of fire that were very beautiful."

Again, page 432 of the same work, the manufacture of still larger rockets is mentioned as having been observed, and the writer says that for the cylinders "the trunks of trees, bored in the manner of a pump, were used, the cavity of the cylinder nine or ten inches in diameter, the wood two inches thick, and length from twelve to twenty feet." And I have heard those who have seen these huge rockets mention that they weigh, when attached to the necessary monstrous tail of large bamboos joined together, from 1000 to 2000 lbs. And in some authors who write upon those countries and Siam, I have read detailed accounts of the execution of criminals by binding them to these monster rockets, and either discharging them perpendicularly or along the ground, and thus putting them to death in a barbarous and cruel way, which is in consonance with the general character of these people.

These quotations will, I trust, cause you to reconsider the assertion that "rockets of 100 lbs. are found not to move one yard."

With regard to Captain Warner's experiment at Brighton, I must say that my opinions entirely coincide with those you

[a] I may mention here, that the weight of the common sky-rocket is generally stated by pyrotechnists from the weight of a leaden ball, of the diameter of the mould in which the sky-rocket case is held when the composition is driven. But with war rockets it has been usual to class them according to their actual weight; thus a 3-pounder rocket weighs 3lbs. without its stick, and 6, 9, 12, 18, 24, or 32-pounder rockets, which are found to be the most convenient sizes for artillery purposes, are named in the same way from their actual weight, *without the stick;* and for all useful purposes, that is, with any *certainty of range*, the attempt to use rockets without sticks is ridiculous, vain, and dangerous.

have published, and I can only regret, for Captain Warner's sake, that he should have demanded so enormous a sum for the communication of "*his mode of proceeding*," which will probably completely close the door against any public remuneration, even for the expenses he has necessarily incurred.

I fully believe that Captain Warner has no *unknown* chemical or electric power to use for his purpose; and I say this, because many simple compounds, already known, are quite sufficient to effect all that Captain Warner has yet done.

With regard to the six mile range, if Captain Warner means that kind of range which we as artillerists speak of when we describe the flight of a shot, shell, or rocket, discharged from one position, and reaching another at a great distance, without any kind of intermediate communication between the two places, except the free atmosphere; then I undertake to say that Captain Warner is unable to accomplish it with any useful certainty of direction; and why, if Captain Warner can do this unknown and justly believed impossible thing, does he not prove it against an empty cask, which might be dropped from a ship in the British Channel, at any point six miles distance from the position on the shore where Captain Warner might be placed, in solitude if he pleased, with his *destroyer?* This would cost only a few shillings, as to the cask, &c., and if Captain Warner's plan is simple, not too costly, and can be used by artillerists, then he would be deserving a reward for adding to our military and naval powers, and he would accomplish what is at present an unknown, and justly considered *impossible thing.*

As to Captain Warner's six mile range with any kind of shell, shot, or combination of rocket, or by firing a charged cylinder out of a cannon, to discharge itself in its course by means of a fuze, although *the range* might I believe be accomplished by the latter plans, the impossibility of *regulating the flight* so as to counteract the constant and varying action of gravity as the propelling composition of rockets burns away, is in the way of such a project being successful against any object of less dimensions than a large town.

Again, if Captain Warner's six mile range is to be accomplished by a communication with the object to be destroyed, by means of a rope, magnetic wire, rods, floating machines, &c., why certainly it can be done; and I wonder that Captain Warner limited himself to so small a range. Why not have proposed twenty, thirty, fifty, or 100 miles? but this is not what artillerists call a range.

Suppose one of Mr. Andrew Smith's beautiful wire ropes[a], attached at one end to an object to be destroyed, and the other

[a] One of these ropes was lately made in one continuous piece, without any joining, of 169¾ miles in length! It was for the Great Western telegraphic line, on Cook and Wheatstone's principle.

end fixed to a position where the *destroyer* is to be discharged, there is no doubt but by a combination of rockets, so arranged as successively to discharge each other, the distance would be easily overcome. I say nothing about the disconnected props on land, or floats on the water, to support the weight of the rope, because that could be managed; but the project is too ridiculous to think of it.

Again, suppose the London and Birmingham line lent for such a silly and mischievous purpose, there is no doubt but that with a carriage properly constructed, and filled with cases containing suitable propelling compositions, successively to ignite each other, that the carriage would fly along the line, ("like a shot," to use a common and applicable expression,) and blow up the terminus at Birmingham in a very *striking manner*, and thus a range of 113½ miles accomplished. But, as I before mentioned, this is not what artillerists call a range.

I will now return to the subject of war rockets; it is one which I have been familiar with for many years, and from the statements given below, you may judge I have had some experience in the manufacture of them, and I feel urged to enter upon this subject, because I sincerely believe that the war rocket is a truly valuable auxiliary to artillery;—in many cases applicable when ordnance could not be brought into action, and from its portability, and carrying within itself its own propelling power, *possesses advantages which no other missile has*. As to the formidable and dreadful power of a large rocket, no one can doubt it; but some of your readers may not be aware that the penetration of a rocket into masses of wood, earth, masonry, &c., at 1000 or 1500 yards, is greater than that of a cannon shot of the same weight.

The remarks you have made upon "explosive compounds," &c., are so true and so chemically scientific, that I should have supposed them to be the opinions of Dr. Ryan, the elegant and delightful lecturer at the Polytechnic Institution, his manner of treating these subjects in his lectures being so similar; but whoever is the writer of the papers on these subjects, I am desirous that he should be informed, as well as some of your readers who take interest in them, of what has been done by myself in improving the war rocket especially, as the writer has published the following opinions:

In alluding to the *Congreve rocket*, page 379, in the number for this month, the writer states—

"The fact is, that no one on firing a rocket can tell which way it will go. At a review in the marshes at Woolwich, before Queen Adelaide, one deviated more than 400 yards from the line of fire, and fractured a drummer boy's leg; at another review, before Marshal Soult, one turned back and struck close to his horse, most fortunately into a deep puddle. *Every endeavour made to correct this has failed.*"

I could mention many other instances of accidents from the erratic wanderings of the Congreve rocket, from my own experience and that of others, and I now state, as I have before, the positive assertion, *and I am ready to prove the cause*, that from the construction of the Congreve rockets, as they were sent to India, and as I believe they are now made, this uncertainty of range must always be expected, and must ever continue if that construction is followed; and I have reason to know, from the best authority, that the errors of flight have not yet been overcome at Woolwich.

I feel it necessary to state here, that I am not in the least acquainted with the processes pursued in the Royal manufactory, or the compositions used; nor did I ever enquire into them, nor have I the smallest desire to know[a]. I speak of the construction of the rockets as sent to India for service from Woolwich, and I have reason to know the defects of the construction, because 3000 of these rockets, being part of a supply which was sent to India, proving defective, were sent to me, when I was agent for gunpowder and superintendent of a rocket manufactory at Allahabad, in Bengal, to be emptied and refilled with my own compositions and on my own plans.

It will be sufficient to state here, that before Sir William Congreve's rocket reached India, and before I knew the rockets were sent for, in the year 1815, I offered to Lord Hastings, then Governor-General of India, to manufacture war rockets for service. Congreve's home interest with the Prince Regent at that time, and subsequently for many years, and even to this day I believe, was an obstacle in preventing my being employed or proving what I could do in a public and satisfactory manner, on the subject of war rockets; and it was not until the supplies of Sir William Congreve's rockets became absolutely useless and dangerous to use in India, that, in the beginning of the year 1824, I was called upon by the Military Board of Calcutta to make a comparative trial of my rockets against an equal number, fifty, of Sir William Congreve's. I was then model-master at the head quarters of the artillery at Dum Dum, near Calcutta, and without a single experienced person to assist me. I made the trial rockets in the small outbuildings of my own private dwelling house, with a few natives to assist me, and all being reported ready, the comparative trial took place on the artillery practice ground of Dum Dum, before Lord Amherst, the then Governor-General, and Sir Edward Paget, the then Commander-in-Chief, and many of the civil

[a] I state this so publicly, because it has been asserted officially, and in private, that I have attained my knowledge of the art of making rockets from Woolwich, which I declare to be an unfounded assertion, and I challenge any one to bring proof that I have ever entered the rocket manufactories, or, to my knowledge, ever conversed with a single operative, or other person, employed in them, on the subject.

and military officers, and a large concourse of scientific and other inhabitants of Calcutta, who were assembled on the occasion. There were two separate targets, at distances, as far as I can remember, of 800, 1200, and 1700 yards. The result of the comparison was so far successful, that I received the congratulations of both high and low on the occasion, and that honest and noble brother officer, Captain now Colonel Charles Graham, C.B., who then commanded the rocket troop, in the honesty of his heart, could not avoid crossing over to my battery after the experiment, and congratulating me on my success. I subjoin the Report of the Commandant of the Artillery, which from the singular cause, *the fear that I should make it public*, was withheld from me for two years, and I only received the copy of it afterwards, through the private friendship of the late Sir William Casement.

REPORT of the Commandant of the Bengal Artillery on the public comparative trial of the Congreve and Parlby Rockets, which took place on the practice ground of the Bengal Artillery on the 31st of May, 1824.

TO CAPTAIN CRAIGIE,

SECRETARY TO THE MILITARY BOARD.

Sir,—I have now the honour to forward a Report on the experimental practice which took place here, with Captain Parlby's and General Congreve's rockets, on Monday, the 31st ultimo.

The detail in the Report will sufficiently explain the practice, and it remains for me to add, that not only from the result of the number of rockets which were put into the curtains by both parties, but also from the apparent flight of the missiles of the two descriptions, I can have no hesitation in giving it as my opinion, that Captain Parlby's rockets had a decided advantage, in the correctness of fire, over General Congreve's.

But it does not appear that Captain Parlby's rockets were propelled with the same force which General Congreve's were, although they had a very considerable velocity, and sufficient to answer good purpose for field service, or even in bombarding, at distances not exceeding 1,800 or 2,000 yards. With bombarding rockets General Congreve had a great superiority of range; add to this also, it must be noted, that Captain Parlby's 24-lb. rocket weighs about 14-lbs. more than General Congreve's, which on some occasions of service might be rather a disadvantage.

It may be desirable to be informed, that Captain Parlby had nothing to do in directing General Congreve's rockets. I had appointed Captain Graham of the rocket troop to that duty, and they were managed by him, assisted by Mr. Allen*,

* Mr. Allen was a protégé of Sir William Congreve's, and I believe was employed with rockets as a midshipman, at Copenhagen; he was afterwards attached to the rocket troop, in Bengal, for several years.

who first brought them out, and the officers and men of the troop: in fact, every justice was done in the preparation and direction, and the practice with them was extremely good.

I have the honour to be,
(Signed) A. MACLEOD,
Lieutenant Colonel commanding Artillery.

Dum Dum,
2nd June, 1824.

It is hardly necessary to make any remarks on this report, because it could do no good at the present day. Had it been communicated to me, as it ought in justice to have been, I could have explained the disadvantages of the want of propelling force from not having the proper means of filling the composition. I could also have explained that the additional weight of my 24-lb. rockets, as is stated in the report, *was purposely made*, because Sir William Congreve had taunted me with the statement that I could not propel rockets as *heavy as his own*—but the additional weight was no necessary part of the principle of my construction. It will perhaps surprise your readers to learn that it was not until two years nearly after this successful trial, and still further losses from defective Congreve rockets had occurred, that I was called upon to establish a rocket manufactory. I had at this time, by the kindness of Lord Amherst, been removed from the station of model-master at Dum Dum, to a higher appointment of superintendent of the gunpowder works at Allahabad; and on the 15th February, 1826, I was publicly called upon to establish a manufactory of rockets, adjacent to the powder works, with a handsome increase of salary for the separate duty.

I laboured with incessant application at these duties, and I may say, night and day; for I had all the buildings to erect, and the machinery to construct from the raw materials furnished me from the Allahabad magazine:—and this without any European assistant, with only the natives of India, and under a climate, for several months in the year, of the temperature of from 90 to 120°, often 120° in the workshops in which I laboured. I had the satisfaction however of proving what I could effect, in a very short time, for I soon despatched some rockets for trial to Meerut, where the rocket troop was stationed; and the following extract of a letter from Captain Graham, commanding the Bengal rocket troop, will be a satisfactory proof of what was effected in so short a time:—

"Meerut, 9th January, 1827.

"I have sincere pleasure in acquainting you, that I have fired 24 of your 32-lb. carcase rockets, and 12 of your 18lb. rockets, marked × shell 1826 A. from 1 to 12, without a single failure.

"General Reynel (of the Royal Service, commanding the

Meerut division of the army) was present the first day, and expressed himself highly gratified with your success. He lamented the want of such auxiliaries at Bhurtpore.

"These rockets ranged beautifully, and far beyond my expectation.

"On the whole, I cannot but repeat my hearty congratulations on the success of your manufacture, so far as it has fallen under my observation."

Thus, in the very infancy of my new establishment, and with every one to teach—the blacksmiths to make the iron cases, the turners to produce exactness in the iron vents, screws, &c.—not one native of my establishment having ever in his life turned a piece of iron before, and with this dreadful climate, and under great domestic afflictions, did I accomplish more than Sir William Congreve, with all his boasted skill, with the first artificers in the world to assist him, could effect, namely, regularity of line of flight in the war rocket. My attention was now directed to compositions, to enable them to resist the effects of the trying climate of the upper provinces. You will easily understand what the difficulty is, when you consider that the iron case expands by heat and dryness, while the composition of a rocket has a tendency to shrink from this cause; and if the adhesion of the composition to the case is once destroyed, the rocket, on being ignited, will probably blow its head out with great violence, and its case and stick recoil in the opposite direction. To guard against this, I may say, I spared neither time, labour, nor thought. In some of my compositions I failed, by the necessary intermixture of different materials, but time only could shew me which was best; and I believe I had accomplished this most desirable end most fully and efficiently, when Lord William Bentinck's* arrival as Governor General, with a determined principle of retrenching public expenditure, suddenly closed the establishment for making rockets, and both the gunpowder agencies of Allahabad and Ishapore, and ordered all the establishment to be discharged.

India being at peace!!! and a certain quantity of gunpowder in store was the cause assigned! But to show what I had ac-

* It was under this Governor General, perhaps, that more harm was inflicted on India than any one preceding or following. Establishments were reduced, public cattle sold off for trifling sums, to be re-purchased at enormous prices; the small pay of a great portion of the army reduced; and the general feeling of this governor seemed to be, that if he thought any one was too comfortable in his home, he had some travelling duty attached to his stationary one; two distant duties thrown into one on one salary, or probably sent from one appointment to another at a distance. Thus in the case of the suspension of the two gunpowder agencies in Bengal, some of the establishment who had been labouring at this dangerous employment for upwards of twenty years, were discharged after a few days' notice! and the establishment of the rocket manufactory, after being completed with considerable labour and expense, entirely lost to the East India Company!

complished, I think it necessary to subjoin an extract from a letter from Captain Blake, commanding the rocket troop, (successor to Captain Graham,) dated Meerut, 21st January, 1828, not two years from the first establishment of the manufactory.

"I commenced (the annual practice) on the 16th instant with 12 of your 18-pounders, at an elevation of 20°, they went all with great steadiness and precision; and on the 18th instant I fired 12 of your 12-lb. rockets; they went all alike, and were allowed by the numerous artillery officers in the battery to be, *in precision, force, and continued length of horizontal flight*, quite unequalled by any kind of rockets they had yet seen or expected to see."

Thus, Sir, I trust you will allow that your assertion "that every endeavour to correct this (erratic wandering) has failed," cannot be borne out; and I shall have much satisfaction, if in the pages of your scientific journal, the above stated circumstances are made public.

Lord Amherst and Sir Edward Paget are both now in England, and many others of the Bengal Military and Civil Service can bear witness as to the public experimental trial at Dum Dum.

I will now conclude this paper, which is rather longer than I intended, by making known that I offered to Sir Hussey Vivian, when Master General of the Ordnance, to make known the principle of construction, &c., which I had invented *(from my own thoughts and experiments)* to improve the war rocket, for the small sum of £5,000. The offer was rejected, as it was not deemed advisable to recommend so large a sum for the purpose, especially as I was told that I *had derived my principal information as to improvements in rockets at Woolwich !!!*

It is true I was a Cadet in the Royal Academy of Woolwich, in the Old Arsenal, or Warren, as it was called before the visit of George III. to it in 1806, and I have a filial affection for the place; and I highly esteem the science and abilities of the officers of that noble corps, the Royal Artillery. It was my hope that by joining my own improvements to the skill in manufacture and fabrication which the laboratory men at Woolwich possess, that the war rocket might have by this time become a valuable, instead of a depised national weapon.

I was invited to Holland, before the separation of Belgium, to establish a rocket manufactory; I have also been invited to Russia, without any communication or application on my part; but to no one have I disclosed either the principle of construction or any thing that could assist a foreign country in the improved manufacture.

To the East India service the rocket is a most valuable weapon, and great errors have been committed, and great expenses incurred, in sending *defective rockets*, even lately, from England.

A supply sent up to General Pollock, previous to his gallant advance into Afghanistan, all proved bad; where they came from I do not know. Sir Charles Napier, I was informed, had a narrow escape from a rocket, in a trial just before he went to Scinde, and the consequence was, that this valuable auxiliary could not be made use of. But I believe it is a maxim with the honourable Court of Directors, that once retiring from their service, the individual can never expect to be employed by them again, although I have the knowledge that they wish to manufacture rockets again in India, and should have been happy to have been instrumental in communicating my knowledge on the subject to younger and efficient officers who might be employed.

The great value of a rocket is, that it has all the power of artillery; and from its portability, and carrying within itself its own propelling power, and in some instances requiring only to be laid upon the ground and discharged, it can thus be brought into action where the use of ordnance would be impossible. You have justly observed, that the size of ordnance is *limited;* I cannot but assert that the dimensions of rockets made upon my principle *are not*, except in the matters I have above stated, expense and machinery. The rocket also carries with it the power of the momentum of matter, combined with that destructive element, fire. At the experiment I have above mentioned, before Lord Amherst and Sir Edward Paget, I laid a 50-lb. rocket upon the ground, without any previous preparation of a tube, channel, &c. I laid it as carefully as I could (certainly in the space of a few seconds) in the direction of the target, which was, I think, at 1000 yards' distance. The rocket ranged as true as an arrow, never rising above the ground more than two or three feet, and penetrated the centre of the target, and the one behind it at a greater distance. It is needless to explain what would be the effect of such a line of rockets fired in volleys of 50 or 100 against an advancing enemy of horse or foot, or even against an enemy's artillery; and it is unfortunate that any rival interests should prevent a formidable weapon from being perfected.

I am, Sir, your obedient servant,

SAMUEL PARLBY,

Retired Major, Bengal Artillery.

Kensington New Town,
Nov. 12th, 1844.

PROJECTILE WEAPONS OF WAR AND EXPLOSIVE COMPOUNDS.

By J. Scoffern, M.D.

Lecturer on Chemistry, at the Aldersgate College of Medicine.

(Continued from p. 349.)

Having given a short sketch of the history of gunpowder, we might at once proceed to its application to fire arms, and other warlike purposes. It seems more natural, however, to describe briefly the chemical nature of this substance, and the history and properties of the ingredients from which it is formed. It may here be as well to remind the reader that gunpowder is not a chemical but a mechanical compound, and that it is composed of saltpetre or nitre, sulphur, and charcoal, intimately commingled and subsequently formed into grains.

It is not our intention to enter minutely into the chemical properties of these substances, but we may remark that their union forms an explosive compound which when inflamed eliminates a large quantity of various gases. Nitre or saltpetre[a], is a chemical compound of nitric acid and potash[b]. It may be made by directly uniting these two substances, but we need scarcely remark that such is never done, except as a matter of synthetical demonstration. In some parts of the world—in India, for example—it is found as a natural efflorescence on the earth's surface; and this, indeed, is the only source from which

[a] The term *neter*, translated *nitre*, is found in the Old Testament, *Prov.* xxv. 20; *Jeremiah* ii. 22. Herodotus and Theophrastus use the word *νιτρον*, and Pliny the word *nitrum*—but these authors seem to mean *natron*, quite a different substance from our nitre. Geller (*Invention of verity*, xxiii,) is the first who distinctly mentions our nitre or saltpetre. The term *saltpetre* is evidently derived from *sal-petræ*, literally signifying rock salt.

[b] Until very recent times the composition and theory of the efficacy of nitre in gunpowder was not understood. Machiavelli (in 1588) seems to veil his ignorance of the matter under a great many quaint suppositions. "Saltpetre," says his translator, Peter Withorne, "is a mixture of many substances, gotten out with fire and water of dry and dustie ground, or of the flower that groweth out of new walles in sellars, or of that ground which is found lose within toombes or desolate caues, where raine can not come in; in the which ground (according to my iudgement) the same is ingendered of an ayrie moistnesse drunke up, and gotten of the earthie drines; whose nature (by the effect thereof) considering, I cannot tell how to bee resolved, to say what thing properly it is. The well learned, and most wise physitions, (besides medicinal experience) by the tast, (finding it salte, and with exceeding sottill sharpnesse, and considering the great byting thereof,) suppose verily that it is of a nature hotte and drie: on the other part, seeing it to be a thing engendred of ayre, and touched of fire to fall in a flame and vapore, and rise with a terrible violence, seemeth to be of an ayrie nature, hotte and moist: and againe, seeing it with shining and glistening whitenesse, as a thing to the nature of water conformable, it seemeth that it may be said, that it is of a watery nature." p. 23.

we derive it. Other nations, however, not having the commercial facilities of England, make it artificially, by a process which was first perfected by the celebrated chemist Berthollet. The origin of the extensive manufacture of nitre is curious, and forcibly illustrates the advantage which may accrue to a state from its cultivation of science. At one period of the French revolutionary wars, operations had nearly ceased, owing to a want of saltpetre, which, on account of the vigilance of the English, could no longer be imported into France. At this crisis Bonaparte applied for aid to his friend Berthollet, who, after giving the subject a short consideration, is said to have made this confident reply, "*Sire, within three days we will make our own nitre,*" and he kept his word.

It would be out of place here to give a detailed account of those chemical affinities on which the artificial manufacture of nitre is dependent. Suffice it to say, that both *nitrogen* and *oxygen*, the gaseous materials of saltpetre, exist to an unlimited extent in the atmosphere, and that under some circumstances they unite with lime spontaneously; thus in old walls we have frequently a nitrate of lime, and by the addition of potash, or substances containing it, such as wood-ashes, to this we obtain nitrate of potash, *nitre*, or *saltpetre*.

Napoleon, at the juncture alluded to, issued a commission for the appropriation of old walls, and other suitable materials, to the manufacture of saltpetre; and eventually lime, rubbish, wood-ashes, &c., were mingled together, in what were called nitre beds, for the sole purpose of forming this compound. Thus France was rendered independent of foreign supply.

It has been erroneously stated by some that Berthollet discovered the plan of thus preparing nitre, which was not the case. The process was known to and described by the chemist Glauber. In Prussia and in Sweden the making of nitre has been cultivated as a piece of state policy. The King of Prussia[a] obliged his farmers to build their fences of nitre-forming materials, which after a few years were taken down and appropriated. In Sweden[b], so careful is the government on this point, that each farmer is obliged annually to furnish a certain quantity, which must be paid in kind—government will not compound for it—thinking that by following such a course it guards against the injurious consequences which might arise during a war if the supply of nitre were drawn exclusively from abroad.

In the manufacture of gunpowder, it is of the greatest possible importance that all the materials should be of the utmost purity. Saltpetre, on its first arrival in this country, is dark, foul, and in other respects totally unadapted to the purpose. Being dissolved in water, the earthy impurities with which it

[a] Considerations on the importance of the production of Saltpetre in England, by William Denries. Also *Dumas Traité de Chimie.*

Berzelius Traité de Chimie, t. iii. p. 391.

is contaminated sink to the bottom of the solution; particles of dust and other light substances rise to the surface, and are skimmed off; whilst nitrate of lime, chloride of sodium, calcium, and some other salts, are gotten rid of by taking advantage of the difference between their solubility in water and the solubility of nitrate of potash. Nitre is more soluble in boiling water than in cold; chloride of sodium (common salt) is not; therefore by drawing off the nitre at a high temperature, the common salt is left behind. Again, chlorides of calcium and magnesium, the nitrates of lime and soda, are more soluble in water, hot or cold, than is nitre; therefore the latter crystallizes, leaving the former in solution. By taking advantage of these beautiful natural laws is nitre purified; one operation, however, not being always sufficient, inasmuch as the least particle of foreign salt, particularly the nitrate of lime and chloride of sodium, materially injures the resulting gunpowder, owing to their powerful attraction of water.

After the purification of the nitre, the next operation to which it is subjected, previously to its being manufactured into gunpowder, is fusion. This is for the purpose of driving off any water that may be *entangled* amongst its particles, (nitre does not contain any *chemically united*,) and thereby enabling it to be weighed with accuracy—nothing more; and it would be well if the operation could be altogether dispensed with, inasmuch as the application of too high a temperature drives off oxygen and binoxide of nitrogen, thus materially injuring the substance—indeed, partially changing it into free potash and nitrite of potash[a]. The fusion should never be effected by a heat greater than 500 or 600 deg. Fah., otherwise the injurious changes take place.

We will now leave the consideration of nitre, for a time, and turn our attention to sulphur, another of the ingredients employed in the manufacture of gunpowder. This substance is one of the few simple non-metallic bodies which frequently exist in nature uncombined. In all volcanic countries it is very abundant; our chief supply is from Sicily, where it is found embedded in thick masses very nearly pure, although not sufficiently so for the purposes of the powder manufacturer. To effect this purification one of two methods is employed. In the government powder mills the sulphur employed is simply fused, when the grosser impurities sinking to the bottom of the vessel, and the lighter ones rising to the surface, leave the intermediate sulphur more or less pure, when it can be withdrawn by a proper contrivance. Some of our private manufacturers have recourse to the same operation, but others purify their sulphur by sublimation, taking advantage of a property which this substance possesses of vaporizing at a temperature of about 170° Fah.

We now come to the manufacture of pure charcoal, which

[a] A Treatise on Naval Gunnery, by Sir Howard Douglas.

lately has been carried to a great perfection, to which cause more than any other, the great superiority of gunpowder now manufactured over that of previous times is mainly attributable. Charcoal, as all are aware, is essentially *carbon*,—that chemical principle which, in a state of absolute purity, constitutes the diamond. Charcoal is formed by exposing animal or vegetable substances to elevated temperatures under circumstances which do not favour combustion; that is to say, air being totally or partially excluded. The operation of forming charcoal depends upon the fact that carbon is indestructible at any temperature, provided air be excluded. As charcoal made from vegetable substances is the kind invariably employed for the purpose of making gunpowder, we may confine our attention exclusively to that variety.

We need scarcely allude to the common plan of making charcoal, namely, by putting billets of wood into a pit, setting fire to them, then covering them with turf, &c., in such a manner that just air enough may be admitted to effect slow combustion. Until lately charcoal made by this process was employed by the gunpowder manufacturer. Very early in the history of gunpowder it was discovered that light woods, such as willow and alder, were infinitely superior to hard woods in yielding good charcoal, but facts of a chemical nature having reference to the further improvement of charcoal were not then known. When we consider how various are the secretions and juices of vegetables—how different in regard to their volatility and destructibility—how variable are the amounts of lime, potash, soda, and other bodies, some of which exist in most vegetables, and which, being devoid of volatility, must remain behind and contaminate the charcoal—it is evident that no inconsiderable amount of chemical knowledge is required in the manufacture of this substance for gunpowder.

The common plan, then, of manufacturing charcoal is found never to yield a result of the greatest possible purity: in other words, it is not possible to apply the due amount of heat, so that all volatile substances may be driven off, without at the same time partially destroying the charcoal. The process now followed is that of distillation; the wood, cut into billets of proper length and size, being inserted into cast iron cylinders or retorts heated to the requisite degree. By this operation not only is the wood effectually charred, but acetic acid, called from its source *pyroligneous*, and *tar*, and pyroacetic spirit, valuable results which formerly were dissipated, are now saved; moreover charcoal thus prepared is said to be more free than any other from potash; a fact which seems attributable to the action of acetic acid in dissolving it out.

For the best kind of sporting powder black dry wood is that employed; willow and alder are used for Government powder; any kind of wood is indiscriminately used for the common

powder. In India the gram-bush plant *(cytisus cajan)*, Parkinsonia, and milk-hedge *(euphorbia tiraculli)*, are found to answer well [a]. Whatever the wood, it should be carefully decorticated, for which purpose it is usually felled in May, when the sap is up. The reason of removing the bark is to prevent scintillation, which would be an exceedingly dangerous quality in gunpowder. All who are accustomed to see charcoal fires, must have noticed how the bark of this material shoots into coruscations, indeed the experimental chemist carefully selects, for the purpose of showing the combustion of charcoal in oxygen gas, such portions of this substance as are supplied with bark, and which in consequence beautifully scintillate.

Having sketched the mode of purifying the ingredients of gunpowder, we will now proceed to the manufacture of this substance.

The saltpetre, melted as already mentioned, and allowed to cool into flat cakes, is taken to the mill, placed on the bed of the trough, and broken to pieces by a hammer; the mill-stones being then set in motion, it is reduced to the state of coarse powder, in which condition it is removed to another mill, very much like that used for grinding corn, and reduced to impalpable powder. The charcoal and sulphur being pulverized in a similar manner, all these ingredients are taken to the mixing house, and weighed out into the proper quantities. Then the charcoal is spread in a trough, and the sulphur and nitre being sifted upon it, all these ingredients are incorporated by the hands. The ingredients being thus imperfectly mixed, are taken to the powder-mill, which is a brick building with a light boarded roof. In the midst of this apartment is a circular trough, provided with a cast iron or stone bed, on which revolve two mill-stones attached to a horizontal axis, and each weighing from three to four tons. Manufacturers are forbidden by law to employ in these operations more than forty-two pounds of composition, on account of the frequent accidents which take place.

The danger varies according to the degree of trituration to which the materials have been exposed, usually, however, it is not great; partly on account of the materials not being perfectly mixed, or if mixed, not grained, and in all cases damp; a little water being purposely added during the operation, not enough however to form a paste. The time during which the operation must be continued differs according to the goodness of the powder required, the nature of the atmosphere, and some other circumstances. At the Government mills the time is usually three hours, and in general terms, we may say from one to six hours. Time, however, is never made a criterion, but great attention is paid to a plasticity which the mass ultimately acquires,

[a] Braddock's Memoir on Gunpowder.

when, in the workman's language, it is said to be *alive*. It then glides from beneath the stones without attaching itself to them, and under the name of mill cake is broken up and conveyed to the press-room [a].

The next operation consists in spreading this mill cake on alternate copper plates, in layers of three inches thick, until the press is full, when a compressing force is applied either by the screw and capstan, or by Bramah's hydrostatic engine. The latter was first employed for this purpose by Sir W. Congreve, and of course is much more powerful than any other, but it is found that the extremity of compressing force capable of being exerted by this machine must not be applied, for in that case the mass is rendered so compact as materially to interfere with the rapidity of combustion, in other words the resulting powder is deteriorated.

The next operation is that of corning or graining—a very ingenious contrivance, without which gunpowder would burn so slowly as to be inapplicable to most purposes. The graining is accomplished in the following manner. In the graining house are sieves, the bottoms of which are made of thick parchment, prepared expressly for this purpose from bullocks' hides, and perforated with small holes. These sieves are so arranged that they can be put in rapid circular motion by the aid of machinery, and each sieve contains two discs of lignum vitæ. Into the sieves is placed the mill cake just described, which by the circular motion to which it is subjected, and the friction of the discs of lignum vitæ, is forced through the minute holes of the parchment in the state of grains. These, however, are not all of the same size, but require to be separated into various lots by the agency of different sieves.

The next operations are drying[b] and *glazing*, without the latter of which gunpowder would look dull. Glazing is accomplished by placing the grains in a barrel fixed on a horizontal axis, and made to revolve with great velocity. It will be seen from this that the glazing is due to friction, consequently some powder dust must result. This is separated from the

[a] Formerly a pestle and mortar were employed for the purpose of incorporating the materials. See *Hanzelet*, Recueil de plusieurs machines militaires, &c., 1620, p. 15, plate. On a larger scale a kind of fulling mill was used. See Modelles, artifices de feu, &c., *par Boillet Langrois*, 1620, p. 98. A modification of this latter apparatus seems to be used now by preference in France, under the name of *Pilon Mill. Memoir on Gunpowder, by John Braddock, Esq.*, 1832. p. 47.

[b] Drying is now usually conducted by steam, at a temperature of just sufficient to drive off the water, but far from melting the nitre and sulphur. Hence gunpowder is always more or less attractive of moisture. Lieutenant Bishop (vide *Braddock, sup. cit.*) proposed the daring scheme of exposing gunpowder, at its last stage of manufacture, to a temperature of 500° Fahrenheit, by which the nitre and sulphur entering into its composition might be actually melted, and thus envelope the charcoal in a dense coat! Gunpowder thus prepared would certainly be less hygrometric than usual, but *we* would rather not be engaged in manufacturing it.

grains by means of a gauze cylinder, into which the whole material is put, and subjected to violent rotation, during which the dust flies off, and the polished grains remain in the cylinder. The operation is now finished.

Most persons are aware that cannon and mining gunpowder is not so finely grained as that for muskets, and this not so finely as gunpowder intended for fowling-pieces. Fineness of grain increases the rapidity of ignition, a quality necessary for the projection of small weights, whereas a certain tardiness of ignition is requisite for the projection of large balls and shells, mining, &c. It would perhaps be more correct to say that the fineness of the grain should always be in proportion to the quantity employed. If several pounds of powder be used for the purpose of projecting a ball, the large grained variety will be found to accomplish the greatest distance: if only, on the contrary, a few ounces, the small grained has the preference [a].

Seeing the great amount of mechanical skill requisite to form gunpowder, and the chemistry which is involved in purifying its ingredients, it will perhaps be interesting to ascertain how our ancestors managed to form this compound. The earliest descriptions we have been enabled to find relative to this subject are of the years 1540 [b], 1588 [c], and 1620 [d].

With regard to the proportion of ingredients in ancient gunpowder, we shall treat more fully hereafter; at present let us direct our attention to the mechanical details of preparing it. Those of our readers who are aware of the extent to which gunpowder may be modified, merely by more or less perfect mixture and graining, the composition remaining the same, and who can appreciate the numerous ingenious mechanical resources which modern ingenuity has enabled the manufacturer of gunpowder to avail himself of, will be prepared to expect that the ancient powder must have been very deficient in many of those qualities necessary to constitute perfection. Our forefathers however proceeded very ingeniously to work, as we shall see. In the first place they prepared charcoal of exquisite fineness by burning the softest woods; nay, sometimes linen rags and straw; the latter substance, however, is decidedly improper, owing to the large amount of silicic acid, or flint, which it contains. Their sulphur was purified by sublimation, like a good deal of ours, and then they obtained it in a state of impalpable powder. Their treatment of the saltpetre was however quite different from that of ourselves. Every one conversant with chemistry is aware that this salt may be obtained in a state of impalpable

[a] Wilkinson on Engines of War, p. 176.

[b] Biringuccio (Vanucchio) De la Pirotechnia, 4to, Venetia, 1540.

[c] Machiavelli Nic. The Arte of Warre, transl. by Peter Whithorne, 1588, p. 27.

[d] Hanzelet's Recueil de plusieurs machines militaires, &c., 1620, p. 15; and Modelles, artifices de feu, &c., par Boillot Langrois, 1620, p. 86.

powder by dissolving the crystals in the smallest possible quantity of water, then applying heat to vaporise this water, stirring the solution all the time incessantly. Now the ancient gunpowder manufacturers very ingeniously took advantage of this circumstance, to secure perfect mixture of the three ingredients. The saltpetre was first dissolved, then, the sulphur and charcoal being added, the mixture was stirred assiduously, by which means all three ingredients were mixed very effectually. As for the graining, our forefathers must have succeeded but indifferently; the mixture was moistened with vinegar, wine, brandy, more frequently than water; indeed this process was thought to add strength to the powder, and it was imagined that vinegar, wine, brandy, &c., being what are popularly called *strong* fluids, were necessarily more efficacious than mere water. Various other nostrums were also occasionally added in this stage, all detrimental, however, to the resulting powder.[a] The next stage consisted in granulation, no previous condensation by pressure having been thought necessary, or perhaps the process had not been thought of[b]. The granulation was conducted exactly as at present.

Now it follows from a consideration of the foregoing circumstances, that, however pure might have been the ingredients, however intimately mixed, the grains of powder must have been deficient of hardness and tenacity, and hence the result must have been very imperfect. That such was the case, is evident enough, from the reiterated directions which are given in all ancient books treating of gun practice, not to bruise the grains by ramming too hard[c].

It would be interesting to ascertain where gunpowder first began to be grained, for unquestionably this circumstance must have greatly enlarged the sphere of its application. This however we have been unable to determine; the earliest descriptions of gunpowder manufacture which we have been enabled to find are those already quoted, and were written at periods when its manufacture must have been subjected to great improvement.

It should be mentioned, that so long as matchlocks were

[a] Machiavelli, transl. by Whithorne, lib. ii. chap. xxiii. For an account of the ancient gunpowder manufacture, the reader may also consult *Biringuccio de la Pirotechnia*, *Hanzelet's* Recueil de plusieurs machines militaires, and Boillot Langrois *Modelles artifices de feu, &c.* In the two latter works the process is illustrated with cuts: the first of the series in *Boillot Langrois* represents a monk weighing out the ingredients, assisted by a somewhat unworthy colleague for a divine, i. e. *the Devil.*

[b] Although pressure is now invariably employed previously to graining, the projectile force of the gunpowder is thereby diminished; however it is rendered more compact and less hygrometric and light than before; advantages more than compensatory for a deficiency of range. See *Braddock's Memoir*, p. 58.

[c] Machiavelli *op. cit. passim.*

used, the powder used for priming was *literally* powder, in other words, it was not grained. This was called *serpentine powder*, deriving its name from that part of the lock which retained the match, and termed the *serpentine;* it corresponds to what we call the *cock*.

We have hitherto paid no regard to the relative quantity of ingredients in ancient gunpowders:—the proportions varied exceedingly at different times, as will be seen by the subjoined examples.

Tartaglia in his *Quesiti e inventioni diversi, lib.* iii. *Ques.* 5, Venetia, 1546, gives 25 different compositions for gunpowder; we subjoin the first and the last,—which at the same time are the strongest and the weakest.

Polver di bombarda al modo piu antiquo.

Salnitro . . . . . parte	1
Solfero	1
Carbone	1

Polver da schioppo moderna.

Salnitro raffinato . . parti	18
Solfero	2
Carbon de legno de nizzolar	3

Machiavelli has copied these tables in full.—See Whitehorne's Translations, p. 31, lib. ii.

Both these compositions must have yielded a very imperfect powder; it is difficult to imagine that the first could have had any projectile effect at all formidable.

Some of the other proportions, moreover, would yield powders scarcely more powerful than the composition of a squib, and altogether inapplicable to the purposes of modern warfare. We must not conclude, nevertheless, that this circumstance arose from ignorance of better proportions; a far more plausible explanation of the fact is, that guns were then so weak, that stronger powders would have destroyed them. No doubt the proper ratio of ingredients to form good gunpowder, can be determined *à priori*, from a consideration of chemical laws; yet it is a remarkable fact, that some time before chemistry was thus far advanced, manufacturers had, by dint of mere experience, discovered the best proportions; that the chemist in this respect cannot lend them any aid. The last great improvement in gunpowder consisted in the use of the cylinder charcoal already mentioned, when the material thus formed acquired such additional strength that the proportion of charges used for ordnance was in consequence reduced one third[a].

If gunpowder, as now prepared, have any fault, it consists in being rather *too strong*. Were it desirable, its strength, by mere peculiarities of manipulation, might be still further increased,

[a] Phil. Trans. vol. ix. p. 358, Coleman's paper.

without any alteration of the ingredients, or their proportions—indeed Sir William Congreve did make some of this gunpowder, but it was found to explode on percussion, besides being in other respects highly dangerous and therefore inapplicable. Those persons who anticipate the accomplishment of a long range by the use of dangerous fulminating compounds, hereafter to be described, should well consider this fact. We here subjoin a table of the composition of gunpowder for different purposes, and the chemical results of its inflammation.

MINERS' POWDER.

	Atoms.	Theory (*per cent.*)	Practice (*per cent.*)	Results of Combustion.	Atoms.
1 Nitre . .	102	63.35	65	1 Bisulphuret of Potassium .	12
2 Sulphur .	32	19.87	20	1 Nitrogen. . .	14
4½ Carbon .	27	16.77	15	1½ Carbonic Acid	33
				3 Carbonic Oxide	42
	161	100.00	100		101

FINE SHOOTING POWDER.

	Atoms.	Theory (*per cent.*)	Practice (*per cent.*)	Results of Combustion.	Atoms.
4 Nitre . .	408	77.71	78	3 Sulphuret of Potassium .	168
3 Sulphur .	48	9.14	10	1 Carbonate of Potash . .	70
11½ Carbon .	69	13.14	12	4 Nitrogen . .	58
				10½ Carbonic Acid	231
	525	99.99	100		525

COMMON SHOOTING POWDER.

	Atoms.	Theory (*per cent.*)	Practice (*per cent.*)	Results of Combustion.	Atoms.
1 Nitre . .	102	75	75	1 Sulphuret of Potassium. .	56
1 Sulphur .	16	11.76	12.5	1 Nitrogen. . .	14
3 Carbon. .	18	13.23	12.5	3 Carbonic Acid.	66
	136	99.99	100.0		136

The enormous force of inflamed gunpowder is known to depend on the evolution of various gases, the volume of which,

when cooled, it is easy enough to determine; but at the moment of their formation they are vastly dilated by heat, so that their actual effective volume and pressure cannot be justly ascertained. It has been pretty correctly ascertained that a cubic inch of gunpowder is converted by ignition into 250 cubic inches of *permanent* gases, which, according to Dr. Hutton, are increased in volume eight times at the time of their formation by the expansive influence of heat. Assuming these data to be true, confined and ignited gunpowder will exert, at least, a force of 2,000 lbs. on every square inch!

Before concluding our notice of gunpowder, it may not be amiss to point out certain indications of its good and bad qualities. Its colour should be rather brown than black; the grains should be firm, not crushing by the pressure of the finger, not clotted together, and totally devoid of smell. Such are the physical qualities of good gunpowder; its chemical characteristics shall be mentioned presently. The disagreeable smell which sometimes arises from bad gunpowder depends on the application of an undue amount of heat in the fusion of the nitre. This effects the decomposition of the salt, causing it to yield up the elements of its acid, either totally or partially, thus leaving nitrite of potash and free potash as residues. Thus, not only is the resulting powder weakened by the absence of the requisite quantity of nitre, but potash is itself deliquescent, and moreover by reacting on the sulphur, forms sulphuret of potassium; this, in its turn, reacting on aqueous moisture, yields hydro-sulphuric acid gas, to which the disagreeable odour alluded to is attributable. The simplest plan of analyzing the gunpowder, (as to the relative proportions of its true ingredients,) is by first dissolving out the nitre by means of pure water, then the sulphur by aid of a solution of potash, thus isolating the charcoal. Each of these substances, when dry, may be weighed.

The solution of nitre should neither precipitate nitrate of silver, (indicative of the presence of common salt and carbonate of soda,) nor blacken a solution of acetate of lead, (indicative of the presence of hydro-sulphuric acid,) nor change turmeric paper brown, nor litmus paper red; the former would be indicative of an alkali, the latter of an acid.

We have seen that mechanical aid contributes no less than chemistry to the perfection of gunpowder; therefore other means of forming a judgment, in addition to chemical tests become necessary. Manufacturers are in the habit of paying great attention to the manner of its burning, whether it ignite rapidly or slowly, whether it scintillate or not, whether it leave much residue, and on the contrary, &c. &c. There are also instruments called *eprovettes* for ascertaining the comparative force of powder; but in our government service the force of gunpowder is ascertained by trying the power of a given quantity in projecting a known weight. A charge of four drachms of fine grained or small-arm powder is expected to project a steel

ball with the requisite force to perforate a certain number of half-inch wet elm planks, placed three quarters of an inch asunder, the first being thirty feet from the muzzle of the barrel [a]. A charge of four ounces of cannon powder must be capable of projecting, from an eight-inch Gomer mortar, a sixty-eight pound iron shot not less than 380 feet [b].

Few persons can be aware of the enormous quantities of gunpowder used for military purposes. At the siege of Ciudad Rodrigo, in January 1812, 74,978 lbs. of gunpowder were consumed in thirty hours and a half; at the storming of Badajos, 228,830 lbs. in 104 hours; and this from the great guns only! [c] At the first and second sieges of San Sebastian, 502,110 lbs. [d] were used; and at the siege of Zaragossa, the French exploded 45,000 lbs. in the mines, and threw 16,000 shells during the bombardment! [e]

(To be continued.)

RAILWAY IMPROVEMENTS.

KOLLMANN'S INVENTION.

On taking a retrospective view of the advance of mechanical science within the last twenty years, we are naturally filled with astonishment and triumph at the vast works which have sprung into existence within so short a period. When we consider that the present enormous investment of capital in the construction of railways, has arisen from the patronage accorded to men of talent, and the surprising march of improvement which has been the consequence, how carefully ought we to examine every proposition, benefiting so largely as we have done, which emanates from the suggestions of genius, and has obtained for this age such pre-eminent advantages.

The improvements in the principle of railways have effected within a very short period a more wonderful stride in the progress of locomotion than the most successful of human efforts have previously achieved.

Railways are now become to the commercial and social intercourse of this country as necessary, as in former days well constructed turnpike roads; and but for one difficulty, that of the enormous first cost, would supersede every other mode of transit.

All inventions at the present day, and in, as it may still be termed, the infancy of railways, justly demand attention, instead

[a] The government powder labelled T.P.F., when new, propels the ball through 15 or 16 boards; and when restoved, through 9 to 12. *Wilkinson, op. cit.* p. 175.

[b] Wilkinson on Engines of War, p. 195.

[c] The British Gunner. Quoted by Wilkinson, Engines of War, &c. 148.

[d] From the returns made to the Royal Arsenal, Woolwich.

[e] Napier's History of the Peninsular War. Wilkinson op. supra. cit. p. 148.

of being met by prejudice, and engineers being themselves slow to examine new principles, ought to be the first to come forward and adopt them in cases where practical improvement is demonstrated.

It is admitted on all hands that great defects and mechanical inaccuracies exist in the present wheel system, and general construction of railways; which must be greatly improved before they can be universally adopted. The enormous outlay in construction must be avoided; lines must be formed and worked at so cheap a rate that they will pay in secluded districts, as does the most expensive system in the principal channels of communication.

Those who have speculated largely in projected railways will, it is feared, soon discover their mistake, as even amongst the present chosen districts of England fifty lines are bringing but from four per cent. down to nothing.

Amongst the various improvements of the day, those of Kollmann in railways take a very high stand, from the simplicity with which many evils are overcome, especially those of the present wheel system, and which embraces more considerable advantages than would at first appear possible from so slight a modification.

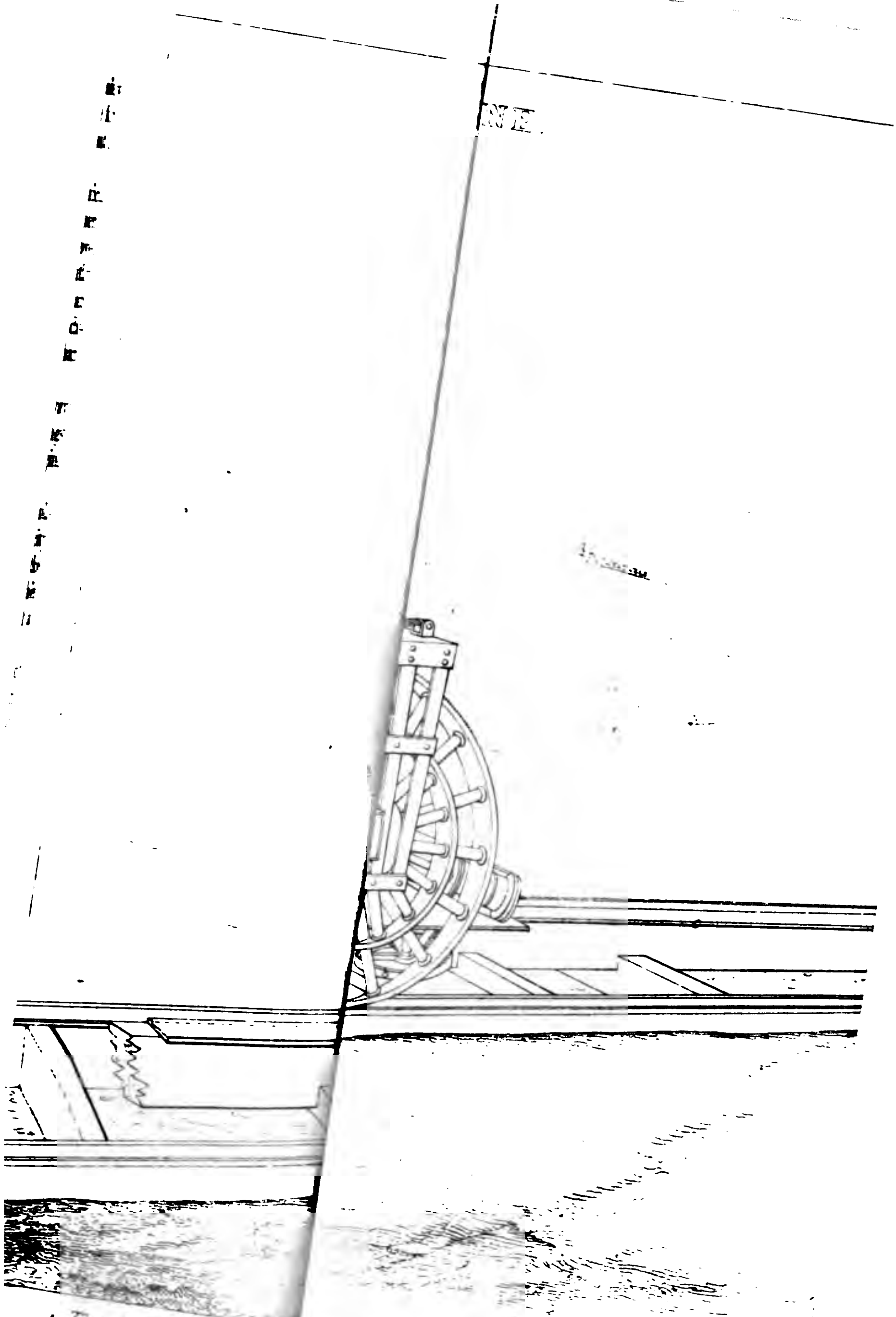
Negotiations are now being carried on for the purpose of laying one line alone of upwards of one hundred miles in length upon this principle, and the interest it excites amongst Railway Companies bids fair for its speedy adoption.

In the present system of railways, it is difficult for engineers to work gradients of more than 1 in 100, with an average train, and without pilot engines, each of which engines, with its consumption of fuel, dilapidations and wages, is equal to a sunk capital of about 15,000*l.*

Secondly—The wheels of engines and carriages are at present keyed square to their axles, so that if put on a plane surface, they would always run in a straight line; nothing short of force will bring them into a curve, the resistance increasing with the smallness of the radius of the curve, against the convex rails of which they wedge themselves.

Thirdly—The coning of the wheels for the purpose of lessening the concussion caused by the lateral action of the carriages, is such as to give the effect of perpetually ascending an inclined plane, as the engine becomes lifted from the lesser to the greater circumference of periphery.

Fourthly—The wheels being of the same size, and firmly keyed to the axles, they must always travel at the same speed, and act as a continuous drag in going round a curve, owing to the unequal lengths of convex and concave rail, which have, nevertheless, to be traversed in the same space of time, as the carriages would otherwise be twisted and torn asunder, which is now only prevented by their great strength, and the skidding motion produced.



a The frame in wheel. e Driving wheel for inclines

...orge Spencer del.

F. Mansell sc.

The first difference in Kollmann's wheel system, is the power of ascending very steep inclines; this is effected by the smaller diameter wheel, which on steep inclines comes into operation upon the elevated wooden rails, fixed in such situations only, and which give a much greater amount of adhesive power than is obtained by iron.

The size of this smaller diameter wheel is of course regulated by the maximum gradients of the line, and the periphery of the wheel is roughed or serrated, in order to effect the necessary amount of traction.

Secondly—The wheels are without flanges, and work independently of each other; they are secured in a frame, and work directed by guide wheels acting against the rails; are entirely independent of the carriages which are suspended in these frames, in which the wheels work, being attached above and below by pivots in the centre. These frames and wheels are turned in the required direction by the horizontal guide wheels, which take the duties of the flanges of the present system, and thus all lateral resistance is transferred from a sledge to a rolling motion; thus the direction being given to the guide wheels by a curve, they turn the bearing wheels into the proper angles, in which direction their natural tendency will be to propel the train, until receiving a new impulse from a different course in the rails transmitted through the horizontal guide wheels.

These foregoing advantages are not alone a saving in the working expenses, as at present 40 per cent. on the returns; but it will shortly be seen that they effect as great a difference in the original outlay.

Flatness is the great requisite in the construction of both curves and gradients upon the present system, and this is purchased at an enormous expense.

Suppose a line of railway to be constructed between two points, with villages, parks, hills, and rivers, intervening. The present curves are necessarily so flat, that before you are well clear of one difficulty you are upon another. Thus, avoiding the village you come upon the park, when frequently the amount of 10,000*l.* or more is paid for compensation. The next obstacle is the hill which is cut or tunnelled through, at a still more ruinous cost; next is the river, and so on. You cannot, serpent-like, wind round and over, and thus evade your difficulties, but must at any sacrifice plunge into the midst of them. Valuable estates are by the present railways ruined and cut to pieces; the natural beauties of a country are hidden and destroyed, as you wind through an enormous cutting, or still more dismal tunnel.

It is estimated that by Kollmann's plan one third may be saved in the construction of a line of railway, and that, coupled with economy in the after working expenses, will reduce it to nearly, if not quite half the present cost.

ON FIRE-DAMP, WITH SUGGESTIONS FOR A NEW SAFETY LAMP.

One of those fearful accidents has occurred which modern science had claimed the power of averting; in a mine, where the safety lamp had been employed, where every attention had been paid to ventilation, the fire-damp has exploded, and the lives of a hundred miners have been sacrificed to its violence. In London, amidst the gay and fashionable world, this excites but a passing interest, even now it is forgotten; but in the mining districts the gloom it has occasioned will long remain. The wives rendered widows, the children fatherless, perhaps cast upon the parish, are not the only sufferers; a feeling of insecurity has been created among the thousands employed upon the works; the wife sees her husband leave her, the mother her son, with the wild dread, that when she again sees him, it may be one of them, a corpse mangled and blackened by the explosion. Yet, even while this fearful accident was fresh upon the mind, the safety lamp of Sir Humphrey Davy was held up by the scientific world as perfect, and the explosion attributed unhesitatingly to the carelessness of those who perished. The truth of such a charge must from its nature remain unknown; those who could alone have spoken, are gone; but if examined carefully, the accusation must be regarded as extremely improbable; the safety lamp in an explosive medium burns very dimly, the flame becomes lengthened and murky, an appearance known to every miner as betokening extreme danger. With this warning it is indeed exceedingly improbable that any one would tamper with the lamp, or would even be, if sufficiently foolhardy himself, allowed by his fellow-workmen to do so; nor do the facts, as elicited at the inquest, bear such an interpretation; on the contrary, the evidence went direct to prove that every possible care had been taken, the lamps had been daily examined, and unexceptionable regulations enforced for their management. In the absence of any clue to this fearful sacrifice of life, Government has justly deemed the question of sufficient importance to require the assistance of Mr. Faraday; and his report, which we hope soon to publish, will be without doubt worthy of his high name; but here, we fear, all will end; the titled owners of the mines are silent, they offer no rewards, they tender no facilities for experiments to remove this danger, their revenue is still raised, and the lives sacrificed to obtain it form no item in their loss. For an invention by which war was to be rendered tenfold more destruc-

tive, and by which the inventor claimed the power of at will destroying a vessel freighted with hundreds of our fellow-creatures, the public excitement has continued; noblemen vied with each other in supporting him, and for several nights the time of the House of Commons was occupied by the endeavours of his supporters to force its adoption upon Government. The deplorable absence of such interest in this, the sacred cause of humanity, devolves upon the philosopher a more arduous task; and if the safety lamp is proved to be defective, it is only by the joint exertions of our professors we can hope for the knowledge of how this security can be attained. The safety lamp depends upon the cooling power of the metallic gauze by which it is surrounded; and the first foundation for the discovery was the fact, as observed by Sir Humphrey Davy, that a flame of 1-30th of an inch in diameter—the size afforded by a single thread dipped in oil—was extinguished when a metallic globule of 1-20th of an inch was brought near to it, and that iron wire of 1-180th of an inch, made into a ring of 1-40th of an inch diameter, produced the same result, while rings of glass, and other non-conducting bodies, though of equal size, had no apparent effect. A succession of experiments similar to these in principle, led to the trial of wire gauze; this, with apertures 900 to the square inch, stops the flame of coal gas, the most inflammable of all the carburetted hydrogens which are found in the mines. The gas supposed to be the fire-damp is a subcarburetted hydrogen; it has little or no smell, and explodes when mixed with twelve times its bulk of atmospheric air; it is formed by decaying vegetable matter, and can be collected from any stagnant pond when the mud is disturbed; it is always found mixed with carbonic acid, but for the purpose of experiment, a gas very similar can be produced by igniting acetate of potash in an iron tube. Now a lamp protected by fine wire gauze can certainly be used without danger in an atmosphere where this gas exists in quantities to form a very explosive mixture; but are we quite certain, that other gases may not be generated inflaming below a red heat, aided by those powerful currents which pervade the mines? On a subject so closely connected with the lives of hundreds of our fellow-creatures, this uncertainty cannot remain without our making every endeavour to remove it. Can it be effected by ventilation? If this explosive gas, the fire-damp, was slowly evolved, then by an admixture of free currents of air the danger might be averted; but there is every reason to believe that this explosive gas is pent up in enormous quantities, and that the labours of the miners give it passage. If so, no system of ventilation, even if sufficiently perfect to change the atmosphere within ten minutes, would be sufficient, and the draught thus produced, would from its force prove a most serious obstacle to the working of the mine. An attentiveexamination of those

accidents, where some have have survived, prove this; we meet continually the expression "the mine appeared suddenly to fill," so as to affect even the breathing of the witnesses. It must be therefore by some modification of the lamp alone, that this great object is to be attained. The great fault in the present system is certainly the lamp drawing its supply of air from the vitiated source of the mine; to prevent the communication of the flame, the wire gauze is rendered almost impervious to the light, which, from the scanty supply of oxygen, is in the first instance extremely murky and dim; the quantity of light afforded to the miner is on that account inconceivably small, and affords a great temptation to use, even at some risk, the naked flame. There is clearly no necessity for this; fresh and uncontaminated air is supplied to the miners, and why should not the same apparatus supply it to the lamp? The foul air of respiration now is removed from the miners, and the same means would be in readiness to remove it from the lamp; thus entirely disconnected from the dangerous medium by which it is surrounded, the lamp would burn with the bright brilliant flame of the Argand lamp. The lighting could be effected without difficulty by the spongy platinum and hydrogen, or by the promethean. Talc in thin leaves could be substituted for glass, if any objection was taken to its brittle nature; but, protected by wire bands, stout glass could resist a much greater force than it would be ever likely to be submitted to by the miners. This plan, we are aware, is open to many objections, but to none which are fatal to its principle. It might entail an expense, we admit, indeed it would; but how trifling, when balanced against the safety and comfort it would afford. There would be difficulty; there would be friction of the air in the pipes, there would be leakage. Undoubtedly these evils would exist, and yet, in defiance of them, we see gas, more subtle and corrosive than air, has been supplied to every house. The danger from leakage would be unworthy attention, for the current of pure air supplied would overpower the slight taint of fire-damp; indeed, as it would be supplied by pressure, it would rather itself escape than suffer the entrance of any explosive compound. Some such plan must evidently be adopted in the present uncertainty; for though the Report of Mr. Faraday has not been published, the belief is prevalent that his opinion will be against the perfect safety of the lamp of Sir Humphrey Davy. A writer in the "Mining Journal" regards it, however, as long since decided; he states at once, boldly, "It is well known that if the Davy safety lamp be exposed to a current of inflammable air, so as to become strongly heated, it is possible for the flame to pass so rapidly through the wire as not to be cooled below the point of ignition, in which case an accident would occur with a lamp of this description, that would be quite safe in a calm atmosphere." "It has," continues the writer,

"been proved by experiment, that flame may in this way be made to pass through the safety lamp as commonly constructed. This fact is quite sufficient to account for the explosion at Haswell." This writer is entirely misinformed, the reverse being exactly the case. In an experiment, no one has ever made the flame to pass. Sir Humphrey Davy threw coal-dust, powdered resin, and witch-meal through lamps burning in more explosive mixtures than ever occur in coal mines; he mixed it even with meal-powder; and though he kept these substances floating in an explosive atmosphere, and heaped them upon the top of the lamp when it was red-hot, no explosion could ever be communicated. The currents on which the writer lays so much stress would have a great tendency to cool the wire gauze, and passing so rapidly through, would be in some respects an advantage, as the slower it passed the more it would be heated. If the writer's views were correct, it requires but a glass shade to protect it from the currents, and thus render it perfect; but the experiments of the lamps with the double tops, for which the Society of Arts presented Mr. Newman with their gold medal, showed that however fierce the current, however explosive the gas mixed with atmospheric air might be, under no circumstances could it be made in an experiment to pass. Some years back it was, we remember, made the point of a lecture to fire an explosive mixture by the safety lamp, giving it a sharp and peculiar twist; and the Lecturer offered to try the experiment with any lamp. One of this description, furnished with a double top, (and we believe, with scarcely an exception, that all lamps employed in the mines are the same,) was given him beforehand, and finding he could not by any manœuvre succeed, he postponed his lecture. Still, in defiance of these facts, the painful feeling is becoming strengthened, that possibly from explosive compounds not known to us being suddenly evolved, the lamp, safe in every severe trial to which the power of the chemist can submit it, cannot yet withstand that unknown power to which in the vast laboratory of nature it is exposed; but though it might entail expense, still it is the bounden duty of those whose princely incomes are derived from mines to devote some small portion of that income to the safety of those by whose hands it is raised.

There may be difficulties in the lamp we have suggested, but were facilities given these might be removed. It is a duty, and the effort, even if unsuccessful, would be praiseworthy. It will be, we hear, referred to a Committee of the House of Commons, and the subject will then receive that share of public attention its importance so much demands.

THE DRAMA.

By James Hine, M.A.

A consideration of the present state of the Drama, (meaning by that term, so latitudinarian in its use, the five-act Tragedy and Comedy of the Stage,) and of the position of its professors, cannot fail to prove interesting to our readers. Few can look back upon the early days of their existence without feeling that they owe very much to the influence of dramatic representation, both as regards their cultivation and delight. It is not true, indeed, that the Stage is a school of morals: its past history will amply refute that oft repeated assertion; but it is true, that it is made subservient to morality by the constraining influence of public opinion. It would extend our inquiry too far to show, by all the arguments which are at hand, that there is nothing *à priori* in the constitution of the drama, or in the social position of the dramatist and actor, to afford any pledge for the inculcation of moral principles, except in so far as they are points of character; but one reason for the actual morality of the stage, and of the moral tone of the subjects brought forward thereon, is so full of gratification that we could not answer it to the tenor of our duty to suppress the mention of it. That reverent homage which the age of chivalry offered to womanhood, has its representative in the deference and respect of the drama. By it her modesty, her purity, are preserved from stain of thought and word. It is from her presiding influence that the stage is now chaste, and not defiled as in those days, when the few women who ventured to the theatre listened, behind their masks, to ribaldries and indecencies which they dared not to witness uncovered.

It is when the age is threatened with the loss of a source of refined pleasure, from which so much of information, so much of the mental impression and outward manners of society is imparted, that we take this opportunity of calling attention to the result which has arrived, and the means by which it has been induced. It may be here observed, that the cause of the decline of the drama is twofold: on the one hand, the decadence is prepared by numerous internal causes; on the other, it is hastened by the external change in the tastes or feelings of the audience. Our readers will perceive that our remarks range themselves under these two divisions. The inquiry is spread over a wide field. It will be necessary to take into consideration not merely the drama, as existing among ourselves, but to extend the survey over the regions through which it has passed, as well as through the surrounding country.

Springing, amoug almost all nations, from the rudest elements and in the humblest form, the drama has always marched with civilization, up to certain limits; beyond these limits it never passes, but often recedes from them.

The history of the Greek drama will afford ample illustrations of this fact. The age of Æschylus is ascertained to lie between B.C. 525 and 456; of Sophocles, between B.C. 495 and 405 (or 401); and of Euripides, between B.C. 480 and 406. Between, therefore, the years B.C. 525 and 405, or during 120 years, the golden age of Greek Tragedy rose and set; or at least reached that point of culmination from which it afterwards rapidly receded. In that interval its form was matured and its capabilities fully developed. The duration of the Comedy extends for about 250 years; but the relics of this branch of Greek dramatic literature are too scanty to allow of its progress being traced with any corresponding degree of accuracy. It is not difficult to discover, in the very essence of the older Greek Comedy, the grounds of a more lasting favour with the minds of the Athenian public; whose opinions, both in philosophy and politics, were courted and flattered by the satire in which that form of drama abounded. It is true that, upon the authority of his function, "ridentum dicere verum, quid vetat?" the comic poet occasionally administered rebukes to the vanity or extravagance of his patrons, which were received with but little good humour by them. This irritability led the poet to seek a less dangerous field for his humour, and ultimately divested the Greek Comedy of its licentious scurrility, by infusing a salutary dread of summary chastisement. This progress, duration, and arrestation of the drama, so singularly uniform in all ages, have been not sufficiently dwelt upon by writers on dramatic literature. Every country in which the drama has appeared in any form worthy of a distinctive appellation, (for in spite of Pope and others, the Epic Poem and the Pastoral Dialogue can hardly be included in the definition of a drama,) has borne evidence to this, its career. Spain and Portugal, Italy, France, Germany, and England, have all witnessed the tragic drama flourishing up to a given point, beyond which we look in vain for any indications of its progress. The growth of the Drama is uniformly rapid; the soil in wich it germinates is no sooner broken through, than it begins to tower on high with giant strength. It is at once independent and parasitic; it uprears its trunk alone and self-poised, but it clings to whatever may adorn or contribute to its aliment. Its independence is in its form, by which, in its early stage, it is so broadly distinguished from the narrative or the didactic poem; its dependence is in its reliance upon those varieties and graces of expression which it can attract to itself, or fasten upon in every other form of poem. The primary food of the drama is man, as an individual, his passions, his weakness. The living exhibition of the con-

sequences which spring from these sources of entanglement and confusion is its province; the operation of those great principles, by which important social or political changes are effected, form no part of its functions,—such are for Clio, not for Melpomene. The dramatic writer must strike his characters with a die, not hew them with a chisel. It will readily be deduced from these grounds that a period of vigorous thought, emerging from the pressure of dense obstruction, such as was produced by the long mental darkness of Europe, would be prolific in writers of a class, wherein concentration of idea walked hand in hand with force of expression. This union may have verged often upon extravagance; but it must be remembered, that this extravagance has been detected by the light of a refined and purified taste, which has in turn almost conducted its votaries into imbecility. But the question arises, how comes it that, in ages when so little had been effected towards the instruction of the multitude, a class of literary production, which demanded in its creators a wide range, nay, the widest attainable range of information, both moral and intellectual, to which future ages should approach in order to draw the very pith and marrow, as it were, of their thoughts; a class of literary productions which called for apprehension, not reflection; which constantly presented ideas remote, and illustrations of subtile research, should take so strong root in the affections of the people? There can be but one solution; the hearts of the audience, not overstimulated by excess of refinement, not educated or flattered into believing themselves an Areophagus of critics, recognised the *nature*[a] when it could not apprehend the *art* of the poet. That very turgidity of expression which Shakespeare often employed, and as often ridiculed, was a source of power over their feelings, for it came mingling the gold with the soil in its headlong course: the home-thought burst the trammels in which bad taste (if you please to call it so) had involved it. Of this reverential feeling Shakespeare himself has handed down to us a remarkable instance, in that scene in the first part of Henry IV., where Falstaff assumes the regal character in the presence of the hostess; whose exclamations show how thoroughly the diction and sentiments of the stage were recognised by the public.

Let the subordinate characters of Shakespeare be studied. The day is past when an imperfect and supercilious criticism ventured to pass them by, or mentioned them only to show a misapprehension of their truth. Let it be observed with what force and truth the moral impress of the persons is conveyed to the auditor. Compare with this vigour (libertine as it may be,

[a] "She (Joanna Baillie) traced its (tragedy's) foundation to that strong instinctive and sympathetic curiosity, which tempts men to look into the bosoms of their fellow creatures, and to seek, in the distresses or emotions of others, the parallel of their own passions."—Sir Walter Scott.

and unshackled by the formal obligations of time or place) the animated pencillings of some of our recent authors, and you will see wherein the secret of a national, or rather an enduring drama consists.

Receding from nature, consigning itself to the suppressive influence of that uniformity which is begotten of gradual social refinement, the tragic drama has reached the confines of dulness, and its professors, whether creative or representative, have fallen from their high estate. With respect to the actor, the evil consequences of the decadence of the drama are manifold greater than to the poet. The area of literature is so wide, the channels by which it is irrigated are so numerous, that the inventive talent of any writer which could force its way through the impediments that beset the progress of a dramatic adventurer, may easily compel both the soil and its streams into his service. Not so with the actor, or representative agent of the drama; in him the very traits which fitted him to his functions are an obstruction. When the drama has flourished, we have beheld the professors, in all ages, received with caresses and consideration by the rich, the cultivated, and the distinguished. Wealth, wit and nobility have combined to weave crowns for their brows, and to set them on in the presence of all. So far did this adoration extend, that the *creative power* of the poet, which had called into action the *representative skill* of the actor, was dwarfed and merged in the shadow of the homage rendered to the latter. History, which has embalmed for us the name of Roscius, has left an impervious veil of obscurity upon those of the poets to whose ideas he imparted vitality. To men so flattered, how severe that change which consigns them to obscurity and neglect!

If the above data be admitted; if it be true that the tragic drama arrives by a rapid growth at its full development; if it be true that this height of development soon attained is never surmounted,—it is quite clear that there is nothing more (except as regards the choice of subject) to be sought for towards the perfection of the drama: it is a picture of man's passions or weaknesses, the broad features of which are as fully developed in the earliest as in the latest ages of civilization; and which but change their hue and outward guise under all its stages of advancement. The characteristics of classes, the conventional inconveniences of society, may awaken a certain interest or afford a passing amusement, by their resemblance to what we ourselves may have gone through, or have observed in our own circles, or have felt to be possible; but they are not the staple out of which the fabric of an enduring drama can be created. Love, hatred, jealousy, pride, ambition, are all at hand for the dramatist; in the rude age of society the workings of each will be most palpable, and simpler in their details. When they cease to be so, they become rather the materials of

the novelist; the complexity of the story defying the brevity which, by the laws of dramatic structure, is enforced upon the dramatist.

Comedy, whose province lies in the form—the essence of that form being reserved for Tragedy—will always be found to survive her sister. It is the tendency of social cultivation to subdue the prominent points of individual character to a certain uniformity. This course effaces from the aspect of the passions those broad and striking traits which in ruder ages stamp the actions of men. Hence that creation of the later ages of the drama, in which somewhat of the two *genera* is found amalgamated, which is distinguished from both tragedy and comedy by the vague appellation of drama, or play.

In the Greek drama, the poets, writing after a long lapse of ages, fell back upon those broad and impressive pictures of society left by the traditions of the heroic era. In these records the dramatic genius of Æschylus, Sophocles, and Euripides found all the materials for their use. It remained to them to set in action and to invest with grave and truthful moral the details which antiquity had preserved to their hands. We must step aside from the direct course of our subject, to observe, with respect to these productions, that they had a certain authoritative or religious character or purpose [a], such as may be found in the early Mysteries, and more recently in the sacred dramas of Mrs. Hannah More, or in the semi-religious writings of the arch-hypocritical age of Racine and Corneille. This may in some measure account for the sudden suppression of this class of dramas beneath the withering satire of Aristophanes, whose keen apprehension detected and exposed the sophistry of the author, and the involuntary acquiescence of the auditory.

In Athens, philosophy, and the ridicule which is so often admitted as its exponent, had been gradually undermining the ancient faith of the multitude. The *heroic* had become more and more merged in the *practical;* and that most severe antagonist to literary dignity and independence, her democratic constitution had stamped its chilling impress upon this class of composition. The satire with which Aristophanes pursued the productions of Euripides, (so intimately connected with the mythological creed of Greece,) naturally tended to identify both the subjects and the treatment of that author with the ridiculous; whence, by an easy transition, it arrived, that the audience resorted to each new representation of the severe kind, no less with a waning faith than with the hope of finding food for their mirth and sense of the ridiculous, with a weakened reverence for the subject, and a declining respect for the poet. However remotely separated the drama may be, in its antiquity and

[a] In the chronologies from which the data of Greek dramatic history are principally derived, we find the production of a play constantly described by some form of the word διδασκω, to teach.

its present condition, there is still this common principle in operation, beneath which, as one of the causes of its decay, it must succumb. When low and mean vulgarisms, clothed in the rhythm and simulated language of the most elevated dramatic composition, had been familiarized to the ear of an audience;—when situations of deep interest had been associated with ridiculous forms and grotesque gesticulations;—when the gait and aspect of those, to whom the most prominent characters in the most honoured dramas were assigned, had become the food of an adroit mimic;—the reverence of apprehension with which the play, no less than the actor, had been hitherto received, soon gave way before that egotistical feeling to which human nature is so prone, and to which exhibitions that tend to debase whatever overtops the commonalty, are so welcome. It would occupy too much space to adduce instances of this consequence: we need do no more than point to the *popular* literature of our day, whether of the stage or the cabinet, in order to supply our readers with a sufficiency of illustration.

When the Committee of the House of Commons instituted, in 1832, so wide and searching an inquiry into the state of the drama, the influence of this vilification of all that had so long existed as the basis of its elevation, seems to have wholly escaped their attention. It is a commonly received fallacy, that nothing which is really good need fear the test of ridicule; that a successful parody, or caricature, is therefore a clear proof of merit in the matter submitted to the unpleasant test. Whatever may be the case with respect to other classes of writings or pictorial productions, (which are, for this argument, upon a wholly different footing,) it is without question that successful parodies of dramatic subjects, upon which the mind has been accustomed to dwell with reverence and respect, if they do not wholly alienate the feelings from them, may so obtrusively recur to the mind, as to destroy that unqualified pleasure with which they were formerly witnessed. Now, as has already been said, this has been done; whether it has been done in self-defence, by any class of actors or authors to whom the pure fountains of the drama were sealed by an enormous and injurious system of monopoly, or out of the mere exuberance of a wanton fancy, matters not. These modern *Aristophanes*, with nothing of his genius but its temerity, and none of his palliations, have rushed "per vetitum et nefas" upon the desecration of those subjects which so many ages have commended to our reverence. This, then, we pronounce to be another source of that decline in the Drama. How shameful—how unworthy of an age, in which (over the dead body of the drama, as it were) the wildest lament has been raised, to find those great elements of the dramatic art, the convulsing passions of the human heart, converted into a source of ribald mockery!—the profound dulness of which is relieved only by the boundless buffoonery of some wanton

mime. It is, we repeat, strange, that when "late hours," "change of habits in the upper classes," "the size of the theatres," "the high prices of admission," "the spread of religious feeling," and a multitude of other reasons were alleged, in order to account for the undeniable decline of the higher branches of dramatic art, so important a point of attraction as this should have been overlooked.

It might be shown that in all European nations a corresponding crisis has arrived. There is no stirring vitality in the creative genius of the stage in any of them, at the present day; (we speak, of course, of the purely tragic and comic classes in their old and received form.) A severe blow also was inflicted upon the influence of the old drama by the introduction and prevalence of those plays in which metrical structure was abandoned, and prosaic diction, the "pedestria verba" of Horace, often of the most unelevated form, adopted; examples of which, in our own literature, may be found in the Gamester, and other plays of that date and class. But the examination into the causes of this stagnation are here designedly limited to our own theatre. We know no better method of proving that the older drama, in its tragic and comic forms, has of late years undergone a serious change in the public estimation, than to point to the two great patent houses—one of which is now wholly closed, and the other opened for entertainments entirely adverse to the interests of the regular drama, as it is commonly termed. But, having attempted to establish two hypotheses by which to account for this result; having endeavoured to show that the creative faculty is exhausted, or at least dormant, and the reverence for the old drama has been sapped by the repeated operations of caricature; we will proceed to add to these a few of the alleged causes of the decline of the drama, as we find them in the evidence to which we have before alluded.

In 1832, the House of Commons, in compliance with a petition laid before them, by certain parties interested in the prosperity of the patent houses, if not in the existence of the drama itself, appointed a committee to receive and report the evidence upon the state of the "laws affecting dramatic literature," and subsequently of theatrical grievances in general. It will be observed that twelve years back the disease, which now seems to have proved fatal, was the subject of serious complaint. That the proprietors of the "great theatres" had become fully aware of the ravages of the disorder, which nothing short of the legislative aid appeared to them able to arrest. In reviewing this mass of evidence, the mind is struck by the indistinct notions which prevail upon every point of the subject. Is a question put respecting the PATENT or LICENCE under which the large houses are opened, no two witnesses agree in their interpretation, or as to the operation of it. Does a question

arise as to what is to be considered the *regular* dràma, the comprehensive answer of an old and experienced stage-manager is "tragedy and comedy and *every thing on the stage*,"—i. e. of the great theatres. Another witness, a gentleman of the highest authority in dramatic literature, defines the "legitimate (or regular) drama to be any drama which has good dialogue, good characters, and good morals," not necessarily in five acts. Again, is it asked, whether the "regular drama" (apart from the interests of those in whose hands the patent right to perform it was secured) should be allowed to be performed at minor theatres, the reader has to wade through a confused mass of assertions, contradictions, and retractations, of the most tiresome character in the evidence of the same witness. Interest, vanity, and jealousy, start up on every side—and this happens in instances where we are compelled to observe their existence with feelings of deep regret. Look at the following answer of one, to whose family the public have accorded the highest honours which their talents demanded, and whose labours were nobly recompensed: "I say, impose *restriction to such entertainments* as these persons (at the minor theatres) were originally allowed to give, and then *I should not be afraid of any number of theatres.*" And again, "when I was a boy, they used at Sadler's Wells, Astley's, and at Hughes's, (now the Surrey,) to give a *certain entertainment*, which they designated '*Burlettas*.'[a] These entertainments were written in a sort of doggerel verse, and were accompanied by a piano-forte, the person playing in the orchestra." Even the miserable privilege of performing *Burletta* was long since invaded by the patentees. In answer to the question, "Do you consider *Burletta* to be the regular drama?" a witness of grave authority and experience answers, "Yes—because Tom Thumb was played at the regular theatres, and is printed and called a *Burletta*." Now we do not hesitate (omitting all consideration of the feeling which suggested these answers) to pronounce it an insult to the stage and its professors. The change of feeling or taste in the public, which made it worth a manager's while to cast off the trammels of submission to which oppressive restrictions had consigned him, and incur the risk of a prosecution, was indicative of the increasing desire of enjoying purer dramatic exhibitions than acts of parliament and royal licences gave access to, in those remote localities to which this witness alludes. They were the growing homage to the drama of classes of the community, against whose approach the great houses had erected a costly barrier. But we will not be tempted into a censure of one so admired and esteemed; a censure rendered wholly unnecessary now, by the extension of that liberty against which he contended. At this moment, the drama, for the sole advantage of exhibiting which the "great

[a] Minutes of Evidence, 222; 735.

houses" pleaded before the House of Commons, chased from their boards, has found, on those of Sadler's Wells and the Surrey Theatres, at once a refuge and a welcome. The doors of Covent Garden are barred against Skakespeare and Sheridan; and a modification of that adverse power (the Italian Opera) so fearfully recognised by the different witnesses belonging to the "great houses," has claimed Drury Lane for its own.

In accounting for the admitted decline of the drama, the favourite hypothesis of the patentee party is the number and invading audacity of minor theatres: that of the more independent section of the witnesses is the increased size of the two patent theatres. Mr. J. P. Collier, the highest authority in dramatic antiquarian research, advances the strongest argument in proof of the disadvantages of their magnitude[a]. That the managers of both Drury Lane and Covent Garden were betrayed by this magnitude is perfectly obvious from the increasing efforts at expensive decorations and appointments which they have been driven to make; wholly forgetting that the aid of dress and equipment, including "*accurate heraldic emblazonment*," of complicated machinery, and numerical force, is in itself but accessory. A spectator no more strongly believes that he is on Bosworth field or the Plains of Philippi, from beholding fifty men skirmishing upon the boards of a theatre, than he did when there appeared but ten. If the power of the author and actor failed to arouse his inward perceptions into that sympathy demanded by the poet, no resources of machinery or supernumeraries can be expected to effect it. At the same time, the nice shades of vocal expression, the passing changes of countenance, the minute play of gesture, upon which the perfection of acting depend, must all be sacrificed to the magnitude of the area. Even the most staunch advocates of the existing houses admitted this result. Mr. C. Kemble, in one of his answers, felt the difficulty, and replied to a question upon this point, as respected the audience, by stating, that "an *equal number* of persons can hear well, I should conceive, in Covent Garden as in the Haymarket." Perhaps so; but if the piece should draw a *greater number* than a Haymarket audience, what is the value of this answer as regards that excess? Few of the witnesses, unconnected with theatres, were found to deny that the vast size of the houses materially impeded a satisfactory representation of the regular drama. It will be remembered that one objection, frequently urged against the acting of the elder Kean, was the (alleged) indifference with which he went through the level scenes in his part. Now, no one who had watched him *closely*, could justly have urged this objection.

[a] "In Shakespeare's time the largest theatre was 55 feet square in the interior; speaking from memory, I should think that the back of the stage from the farthest auditor was 55 feet."—Min. of Evid. 285.

Himself the creature of passion, Kean knew its hidden workings, and was fully aware that mute gesture, or whispered mutterings, (wholly inappreciable at the extremities of a large area,) are as certain indications of the under current of feeling, as the most noisy declamation and wildest gesticulation. "It is much more easy," says Sir Walter Scott, in his admirable article, "Drama," in the Encyclopædia Britannica, "to preserve a tone of high and dignified declamation, than to follow out the whirlwind and tempest of passion, in which it is demanded of the performer to be energetic without bombast, and natural without vulgarity." Another point, arising out of the magnitude of the houses, does not appear to have been sufficiently enforced upon the attention of the witnesses; as to the reluctance, namely, to incur the expense attendant upon producing a new play, which must have pressed strongly and very naturally upon the minds of managers. An author would reasonably expect (and the public would join in his expectation) that his drama should be produced with all those attendant advantages which established dramas had lavished upon them. However secure a dramatist might feel as to the intrinsic merits of his composition, he could not escape the conviction, that the public mind had been progressively tutored into a belief that display is an important element in dramatic representation. The moment, however, the influence of dramatic exhibitions is drawn from the *moral* to the *mechanical*, the fate of the drama, involving both dramatist and actor, is sealed; the functions of intellect begin to succumb to the inventions of the mechanist and property man. As a direct consequence of this, we find it stated, not without some bitterness, by a highly successful living dramatist, that "the public has ceased to look upon plays as part of the literature of the country."

In the plenitude of that power which the licences of the royal patent theatres were assumed to confer, there was nothing too great or too trivial for their notice. Competition with Sadler's Wells in Aquatic display; with Astley's in Equestrian; nay, with the migratory managers of Smithfield, in Zoological, was greedily entered upon. For each of which successive degradations of the boards of the "great houses" the unhappy public was made answerable; with what justice, we leave to be decided by a reference to the present deplorable results. These exhibitions were not due to any public demand for them, but to the cupidity of the managers of these protected asylums of dramatic genius, who saw that they were productive in other places. With this principle of action, we, and others with us, would have had no right to quarrel, if a fair field of action had been allowed to those humbler establishments from which the lords paramount of the drama never hesitated to borrow any successful ideas.

While, however, this suicidal system of management was on

its growth, there was springing up around it a new style of dramatic amusement, which, relying upon a minute completeness in its details, and guided by a refined taste, stole into the affections of the public; we allude to the "Pieces of Society," produced under the superintendence of Madame Vestris, at the Olympic Theatre. There all that was aimed at was well attained: actors who had found themselves unequal to the labour of sustaining characters on the spacious boards of the patent theatres, and whose career had appeared to be closed, came fresh before admiring audiences who had despaired of again enjoying their talents. The pieces produced were, it is true, ephemeral, and contributed nothing to the elevation of or restoration of the drama; but they were amusing, and the actors were both visible and audible by the whole audience. With respect to these pieces it may be observed, that they have made comedy (in its old form) a much more difficult matter of attainment, by fixing the interest of the plot not upon the characters as the representatives of classes, but by drawing attention to the peculiarities of the actor. Much amusement was thus at the moment attained, but a step further towards the displacement of the drama was the proximate result. But all these causes, even if united in operation, have been surpassed in their effects by the new direction given to public sentiment by our modern novel-writers, among whom Sir Walter Scott stands preeminent. Before his prolific and captivating genius, the grave and prudential restrictions upon novel-reading rapidly vanished: thus a new source of domestic pleasure and excitement was opened. Passions were stirred, sympathies kindled, scenes and actions vivified within the quiet chamber, where none of the interruptions of a theatre occurred to mar their influence. Add to this, that new and deeply interesting sources of interest, in the untrodden paths of our country's history, were opened by the wand of the Northern Magician, who supplied to these *dramas* the scenery and images of the dramatis personæ, no less than the dialogue. Under this witchery, as the majority of mankind can rarely entertain two ideas at the same time, the drama of necessity gave way.

This abandonment to one object, so strong a feature in the public mind, has more recently developed itself in another absorbing form—the cultivation of music, and addiction to the lyric drama, or opera. That this kind of theatrical entertainment should be widely popular, need surprise no one who reflects upon the superficial character of musical impressions, and of those most open to them. We derogate nothing from the art, or position of those employed in its exhibition, in asserting that the effects of operatic or lyrical dramas fall immeasurably short of that dignity which all ages have concurred in assigning to tragedy. Were the powers of language employed in both classes equal, were the talents of the performers

capable of parallel, there would still exist a source of disability under which "*the opera*" must always labour, arising from the very nature of musical treatment. We need only point to the constant and unnatural interruptions to the working of the scene, occasioned by those merely mechanical displays of vocal power known either as bravura, cavatina, aria, or by whatever other name the composer has distinguished these commonly the most popular portions of his work, which are the most hostile to and subversive of the *rationale* of the drama as a picture of life. Had ridicule been indeed the test of truth, these excrescences must long since have disappeared from the stage. But in fact, it is in them, and not in the dramatic basis of the work, that the superficial lover of music finds the reasons for his support of the opera.

A great deal of useless speculation was once indulged in by the learned, to prove the Italian lyrical drama to be the legitimate descendant of the ancient tragedy. Whether they succeeded to their own satisfaction or not, at the time of their investigations, we may safely say that the child now retains no traces of its parentage. It may suffice to observe upon this point, that in the Greek drama the music was wholly subservient to the words, perhaps only auxiliary to the recitation of the actor; whereas in the modern opera, both sense and sound in the diction are cast at the feet of the composer. The most obvious of sentiments, in the most common forms of expression, are deemed, and admitted by the public, to be sufficient for the purposes of the lyrical drama. Adepts in that school of poetry which Valentine, in Congreve's "Love for Love," recommends to the attention of his valet, the authors of operatic dramas reproduce, year after year, the same dull thoughts, enveloped in the same "fatal facility of octo-syllabic rhyme," knowing that to occupy the outward chamber of the ear is the ultimate object of the composer. The highest praise to which the modern lyrical dramatist can aspire, is of so conventional a kind, that it is difficult to ascertain how much is due to his genius, and how much to the ignorance of his audience. It may be left to the judgment of the reader to decide upon the justice of our assertion, and it may assist him in forming that judgment, to point to the operas which have been added to the *repertoires* of the European theatres during the last ten years. In them, if he find interesting incidents, he will find no commensurate ingenuity in the conduct of the plot. If he find the germs of thoughts, he will find them crippled in expression. Under such circumstances the wonder is, not that some eminent vocal actors have made strong impressions upon their audiences, but that they have made any. The lyric drama, however enriched by the contributions of Metastasio, has received little at the hands of our poets. Since Sheridan, no name of eminence as a dramatic writer has appeared in its

service. It is but fair to presume that, had the real opera (for such is not the "Duenna") contained in its essence the characteristics of the genuine drama, the high priests of nature and passion who have adorned our poetic annals would have consecrated to it some tributes of their genius. But we look in vain among the authors of *libretti* for the names of Scott, Campbell, Byron, Bulwer, Hogg, or Coleridge. Had the "lyric drama" possessed the power of appealing to the sympathy of these,—had, in short, there existed in her any trait of nature, unalloyed by the merely artificial, what would not the romantic, or impassioned, or pastoral, or reflective minds of such poets have effected for her cause? We conceive that it is not necessary that in these pages we should defend ourselves from the imputation of hostility towards music or its professors. It is only when we find the voice of Nature quelled, and utterance apparently wholly forbidden to her, in those seats where she has so long sat enthroned, and when we behold the public rushing into a state of oblivion of all that has been done by the drama, and extinguishing for ever that honourable ambition which has until lately animated the genius of a Knowles and a Bulwer—it is only when forced thus into an examination of the respective merits of the two classes of theatrical exhibition, that we feel compelled to utter any disqualifying censure upon an art which we so deeply venerate. But the *cestus* is put on—the charm is complete—and before the Venus of the drama, both the Juno and the Pallas must veil their brows. It is in vain to look, unless with the eye of hope rather than of prophecy, for the restoration of the majestic drama. When the eye and the ear, in their outward uses, shall have been indulged to satiety; when from the individual actor, the few who yet remain bound to the allegiance of the olden drama shall have learned to project their attention upon the entire scene; when some new fountain of reverence for the severe and solemn shall have been broken up; when some all-compelling genius, (like that of the elder Kean,) bursting through the impediments of position, form, voice, and manner, shall blaze forth across the dark void of the stage; when, roused by his successful energy, the slumbering spirit of dramatic poetry shall once more awaken; when Nature and her language shall be summoned by the poet to displace the socialities or conventionalities of modern comedy; and, above all, when the author or poet shall dare to assert his belief that the elements of the drama may be as readily obtained by an analysis of the hearts of his fellow countrymen, as by the transference of the most vivid portraitures of foreign manners and sentiments; when the elegant flippancy of the French school, and the morbid pathos of the German, capitivating the auditor, at first, by a fascinating brilliancy or insidious tenderness, shall have given place to sentiments which have their source in the distinctive feelings of our country, as we find them formed

by education, or elicited by accident; when, moreover, a national theatre shall be found, upon the boards of which the actor need not rant, or mouth, in order to communicate to his hearers the whisperings of a disturbed conscience, or the confession of the most tender sentiments; then the drama, in its time-honoured sense, may resume her sway upon the thrones whence so many combined foes have—may we hope for a time only?—expelled her. In the mean time, her advocates and supporters must not slumber; they must be up and doing. Of late years, too much has been left to be done by a few; we had almost written, *by one*. In the highest walk of art there must be variety, and novelty, and originality. Upon the actors lies the burden of the day; they are in the forlorn hope. Let them show that talent needs little aid from the mechanist and tailor; that the human voice, and eye, and form, are the exponents of human passion; let them study abroad as well as at home; in the street as well as in their closet; and in tones and gestures dare to be themselves. So came Garrick and Kean, and with them a "glorious summer" for the Tragic Drama, at whose feet may again be flung those bright (aye, and yet brighter) coronals, which Fashion now heaps upon her usurping sisters, Music and Dancing.

REVIEWS.

The Monster Telescope erected by the Earl of Rosse. Sheild and Son, Parsonstown.

The object of this volume is to place before the public such an account of the telescope, which has been constructed by the Earl of Rosse, as will make the manufacture of the specula, and the mechanism of the instrument, fully understood. Illustrations are given which materially assist the text. We learn that "having satisfied himself by experiments with lenses, that the refracting telescope could not be much improved, Lord Rosse turned his attention to reflectors; and as the first object of experimenters had always been to increase the magnifying power and light by the construction of as large a mirror as possible, so was it to this point that his Lordship's attention was also directed.

"Previous to his experiments, there had not been any instrument constructed, with the exception of Sir W. Herschell's, which had given an opportunity of sufficiently well enjoying the advantage of the reflecting telescope; and even of this it has been lately stated [a], that it possessed but little, if any, practical superiority over others of smaller size.

[a] Vide Dr. Robinson's speech at the Cork meeting of the British Association, 1843.

"Since Newton manufactured his specula until the present day, there have been several opinions, both as to the metals to be employed in their construction, and the quantities in which they should be mixed—some have recommended various proportions of tin and copper; some have added arsenic; some silver; some antimony; and others the three together—the general aim of all the operators being to increase the whiteness, and to diminish the porosity and brittleness of the compound: for the last named property has destroyed a much greater number of specula than it has allowed to be completed—it is the 'asses' bridge,' over which few have been fortunate enough to travel. The compound metal is exceedingly brittle; and requires the most cautious and well regulated cooling, after having been cast, to insure its ultimate success; the very operation of grinding—by the heat the friction produces—having often destroyed the labour of many weeks. The grinding of specula used to be performed by the hand, no machinery having been deemed sufficiently exact; the tool, on which they were shaped, being turned to the required form, and covered with coarse emery and water, they were ground on it to the necessary figure, and afterwards polished by means of putty or oxide of tin, spread on pitch, as a covering to the same tool in the place of the emery. To grind a speculum of six or eight inches in diameter, was a work of no ordinary labour; and such an one used to be considered of great size. Mr. Ramage's reflecting telescope—the mirror of which is fifteen inches in diameter, with a focal distance of twenty-five feet, was, till lately, the largest in use. Sir J. Herschell's, which stands in the place of his father's large one, has a speculum eighteen inches in diameter, and a focal distance of twenty-five feet. With the difficulties of the undertaking, and the small success of his predecessors, Lord Rosse was fully acquainted, but he set about the work with a zeal that was a presage of his triumph.

"After many trials, as to what combination of metals was most useful for specula, both as regarded whiteness, porosity, and hardness, Lord Rosse found that copper and tin, united very nearly in their atomic proportions, viz:—copper 126.4 parts, to tin 58.9 parts, was the best. This compound, which is of admirable lustre and hardness, and has a specific gravity of 8.8, he has used with both the small and large specula, and he finds it to preserve its lustre with more splendour, and to be more free from pores than any other with which he is acquainted. Having ascertained the proportion to be used, he set about the casting of the speculum. The difficulties attending this process were such, that instead of having the reflector, which was to be three feet in diameter, in one piece, he tried the expedient of casting it in sixteen separate portions. When cast, the pieces were fixed on a bed composed of zinc and copper—a species of brass, mixed in the proportion, copper 2.75,

zinc 1—which expanded in the same degree by heat as the pieces of the speculum themselves; they were then ground, as one body, to a true surface, and, when polished, were found to answer remarkably well. The particulars in the manufacture of this compound speculum requiring attention, are, First—The method employed to find the quantity of zinc and copper which would, when mixed, expand in the same degree as the speculum itself. Secondly—The form into which the brass was made. Thirdly—The manner in which the speculum was joined to the bed. Fourthly—The method in which the pieces were cast. And Fifthly—The grinding and polishing.

"In order to find the proportion of the zinc and copper, a bar of the speculum metal, fifteen inches long, and one and a quarter thick, was joined accurately to a bar of the brass of the same length, but only three-quarters of an inch thick; they were then placed in a vessel of water, whose temperature was lowered to 32 degrees F., and a fine hair line drawn evenly and continuously across both; the temperature of the water was then raised to 212 degrees, and during the expansion, the line was examined with a microscope; when it remained perfectly straight across both speculum metal and brass, it was evident that they had equally expanded, and that the desired compound had been attained. There was much difficulty experienced in the melting of the brass, as the zinc being volatile, it was in less quantity after this operation than before it, and the loss it sustained was not always the same. After many endeavours to remedy this defect, it was found that a certain result was obtained, by spreading over the metal a layer of powdered charcoal, two inches in thickness; the loss sustained was always, in this case, constant, and amounted to $\frac{1}{180}$th of the zinc employed.

"The bed was cast in eight pieces. The depth of the bed was five inches and a half, and it weighed four hundred and fifty pounds. The eight portions were soldered together along the sides, and iron bolts used to secure the joinings more perfectly. However, it was found, when the speculum was fastened on, that the joints had given in different places, as was evident by the effects produced in using the telescope. The speculum was therefore taken off, and the following device, technically termed "burning," was had recourse to. The entire brass work was embedded in sand, and covered to the depth of three inches. Down to the centre was bored a hole, one inch and a half in diameter; and into this, from a height of ten inches, was poured a stream of melted brass, similar in composition to that of which the bed was composed, till forty-five pounds had overflowed the surface of the sand. This operation was repeated in thirty-four different places on the combined edges of the portions of the brass bed. The constant heat kept up by the stream on these parts, fused the metal, which contracted on cooling, and united them perfectly in these

situations. The other surface of the bed was attempted to be managed in the same way, but the process failed here; some of the brass was therefore chiseled out of the necessary points, and more melted in, which contracted when cool, and fully answered the desired end.

"When it was found that the joinings were now secure, the speculum metal and bed were again soldered together; this, however, was no easy matter, and gave rise at first to much annoyance and loss of time. It was attempted to solder them by tinning the brass bed, and placing the speculum on this with resin interposed, then raising the temperature, and using slight pressure when the tin and resin were fused. However, the latter becoming decomposed during the elevation of the temperature, effectually prevented any union taking place.—Sal ammoniac was tried with no better success. The process was therefore modified, and the junction of the metals was accomplished in the following manner.

"The pieces of the speculum metal being ground by the hand to fit the brass bed, they were scraped on one side with hard steel chisels, no spot being left untouched, and made perfectly dry—the brass was also scraped and tinned, and all the resin washed off with turpentine, and afterwards with soap and water. The speculum was then laid on the brass, and both were placed in an oven with an iron bottom, and supported on bricks. When the tin was fused, which was effected in eight hours, by a gradually raised temperature, melted resin and tin were poured in between the plates, and they were moved gently backwards and forwards. The fire was withdrawn when the tin commenced acting on the speculum, and the pieces being settled into the places where they were to remain, $\frac{1}{20}$th of an inch apart, all was allowed to cool gradually, and in five days it was ready to be ground.

"The casting of a speculum, and its preservation from breaking when cooling, has always been found a matter of the greatest difficulty. The compound is so exceedingly brittle that any sudden change of temperature is likely to destroy it; and it requires to be so free from pores, that unless great care is taken to give exit to all the air contained in the melted metal before setting, it is rendered useless. In casting the pieces of the compound speculum, Lord Rosse first tried the plan recommended by Mr. Edwards, making the mould in sand, but the speculum was almost always full of flaws, and generally flew in pieces when setting; on attempting to put the parts together again, it was found that they no longer fitted in their places. It was evident, from this circumstance, that they must have undergone some great strain; and it was judged that this had been produced by the unequal cooling of the different portions—the edges becoming solid first, left the centre fluid, and this being, when about to set, unable to contract, was strained when

no longer ductile. The failures in this way were so frequent, that another plan was tried, which was this:—A number of equidistant plates of iron were placed in a crucible with the fluid speculum metal, under the idea that it would be divided, when solid, into an equal number of specula. But this plan had no success at all; the plates were always full of flaws.

"The next attempt was much more encouraging; a block of the speculum metal was cut into plates by a circular sawing machine, the blades of which were of soft iron, kept constantly wetted with emery and water. This process gave pieces that were entirely free from flaws; however, the texture was not perfectly uniform throughout, for near the circumference, the arrangement of the particles was not just the same as in the other parts, so that it was feared that a good speculum would not be formed. It has, however, never been sufficiently well tried; another method having been discovered before this was fairly tested. This process, which has deservedly stamped Lord Rosse's name with celebrity, and reduced the casting of specula to a certainty, is perhaps, the most deserving of praise of all his lordship's works. The simplicity of the contrivance, probably at first sight, makes it appear a result of no great wonder: but, like the plan pursued by Columbus to make the egg stand, it is only easy when known. It has been stated, that the chief conditions, so hard to be attained in the manufacture of specula; are, First—Certainty of not breaking in cooling; and, Secondly—a freedom from pores, if it has been so fortunate as to escape the first. Now, we saw that the mould of sand did not fulfil the first intention, from the unequal contraction the metal suffered when cooling; on this account a mould was made of cast iron, in the hope that its high conducting power would lower the temperature of the bottom portions of the fluid metal first, and abstracting the heat much more quickly than it could escape from the surface, it would cool the metal gradually towards the top, and, in this manner, prevent any part of it being strained. In order to keep the under surface of the mould at a low temperature, a jet of cold water was made to play on it while the speculum metal was cooling; but, unfortunately, the cold water almost always cracked the mould, and, of course, the casting was destroyed when this occurred before solidity had taken place. This plan was, therefore, also, unsuccessful. It was then attempted to procure a perfect casting, by making a mould having the sides of sand and the bottom of iron, and using no jet of cold water. This was so far successful, that it answered the purpose for which it was intended; that is, cooling the metal gradually from the bottom, and preventing any flaws or breaking; but the air, not having the porous sand beneath to give it exit, lodged between the mould and the iron bottom, and formed large holes which rendered it useless. Now the great object to be attained

was, to find some way of allowing the air to escape, but still to retain the iron bottom. In effecting this consists the great improvement in casting specula, without which, the magnificent instruments Lord Rosse now possesses would never have been in existence.

"Instead of the bottom of the mould being of solid cast iron, it was made by binding together tightly layers of hoop iron, and turning the required shape on them edgewise. This mould fulfilled all the requisite intentions. The iron shape conducted the heat away through the bottom, and cooled the metal towards the top in infinitely small layers, while the interstices, though close enough to prevent the metal escaping, were sufficiently open to allow the air to penetrate. The next casting was perfect, and in all succeeding trials the results have continued to be successful. The shape requires to be perfectly dry before being used, and is heated to 212 degrees F. without impairing its cooling power. It must be of sufficient thickness to conduct rapidly; never being thinner than the speculum to be cast. The metal entered the mould by the side, as rapidly as possible; and, before being cast, was heated until, when stirred with a wooden pole, the carbon reduced the oxide on the top, and produced a clear and brilliant surface. Immediately on becoming solid, it was removed to an annealing oven, and cooled slowly. A plate nine inches in diameter requires three or four days to anneal. We will here notice a circumstance worthy the attention of those who may be in future engaged in a similar attempt to his lordship's. In melting the metal it was found that, when fluid, it oozed through the bottom of the cast iron crucible employed to contain it. The imperfect part was cut out, and the hole stopped by a wrought iron screw. This, however, was ineffectual, as other parts of the bottom were alike defective; and it having been discovered that the porosity of the crucible resulted from the fact of its being cast with the face downwards, which caused the small bubbles of air to lodge in the then highest part, Lord Rosse had some cast in a contrary direction in his own laboratory, and obtained vessels perfectly secure and staunch.

In the melting of the metal, turf fires were found sufficiently good, without being strong enough to endanger the crucibles, and they were more steady than those produced by coke. The process by which the plates were soldered to the brass bed has already been described; and to complete the history of the compound speculum, we have now to notice the grinding and polishing. Before this, however, we may remark that the porous iron bed above described, gave, in so many trials, such perfect results, that a speculum three feet in diameter was cast in one piece, and went through all the steps of casting, cooling, &c., with success. There was no difference in the manipulation of this and the compound speculum, except, of

course, that it did not require any brass bed to be soldered to; it was cast in an open mould, and was allowed time in proportion to its size to anneal. It is this three foot speculum that is at present in the telescope erected in his lordship's lawn. It was not, however, chosen for this situation on account of its superiority over the compound speculum, as there could be scarcely any difference found to exist between them: there is, however, a slight diffraction of light, caused by the edges of the pieces of the latter, but it does not interfere to such a degree with its performance as to be taken into account. The processes of grinding and polishing were precisely similar in the case of each, and the machinery was the same. We premise that the moving power employed was a steam engine of three horse power, which was also made use of for many of the other processes connected with the manufacture: one horse power is sufficient for grinding. The several parts of the machinery are connected by bands of leather in place of toothed wheels, which would be more liable to accident.

"Specula used, before the existence of these we are describing, to be polished with the hand, and were subject to the greatest uncertainty of result. The shape on which they were worked was placed on a support, so that the manipulator might move round it. The speculum was then ground down by rubbing it backward and forward, and at the same time, getting a sort of circular motion from the movements of the operator round the support. The process was laborious, and not to be depended on. The velocity with which the hand moved varied constantly—the temperature was never regulated, and the pressure on the several parts of the surface was not the same.

"In order to get rid of these defects, and if possible to produce a surer and better result, Lord Rosse invented his machine for grinding."

In the Philosophical Transactions is to be found a description of the machine invented by Lord Rosse for grinding and polishing the speculum. Our author furnishes us with a view and explanation of the machinery by which this great telescope is worked. We anticipate, together with the noble lord, most important results from this instrument: the first great proof of its superiority has been found in the great quantity of light which has enabled him to see appearances in the moon which were before invisible: and though, as yet, but little has been attempted, we look forward to the trials under favourable circumstances of this important means of investigating some of the wonders which surround us.

Madeira Illustrated, by ANDREW PICKEN. *With a description of the Island, and information for Invalids. Edited by* DR. JAMES MACAULAY. Day & Haghe, Gate Street, Lincoln's Inn fields. *Second edition.*

WE hail with pleasure the appearance of a second edition of a book so valuable both as a work of art, and as presenting pictures, with the pen and the pencil, of an island that creates so much interest as Madeira. Mr. Picken, who is, we believe, the son of the author of the "*Dominie's Legacy*," &c., and is himself at the head of his profession as a lithographic artist, was compelled by his ill health to seek that last refuge of the consumptive, and took advantage of the opportunity to present the public with a series of views of the island, which are drawn and lithographed in the highest style to which these arts have as yet been brought. Some of the designs, such as the "Town of Funchal from the Bay," the "Sea Wolf's Den," and "O Rabaçal," present scenery of the most perfect kind, and as if nature were endeavouring to suit every taste, the views gradually change from the stern mountain crag to the calm and smiling landscape. The letter-press is also most excellent. We cordially recommend this work to all amateurs of magnificent scenery, not only as the most picturesque and highly finished we have for a long time seen, but as presenting a rich diversity of character to that of more known and generally illustrated countries of modern Europe.

Some of the lithographs indeed are perfectly magnificent, and at once prove Mr. Picken to be one of the first drawers on stone of the present day, a talent shared, however, in an eminent degree by other members of his family. It is deeply to be regretted, however, that the insidious disease which drove the talented artist to the island of Madeira, and to which we owe the splendid series of drawings before us, has not been abated by the visit to a milder clime. We praise his work therefore with a melancholy satisfaction, a satisfaction at the eminent artistic skill which characterizes them, and deep regret at the probable fate of a young, talented, and original artist, for Mr. Andrew Picken is no mere copyist, his works have the stamp of genius upon them, and without genius there is no true originality. Every lover of art should purchase this admirable work, and every proposed visitor to Madeira should make it his *vade-mecum*.

Coombs's New Phrenological Chart. Revised by C. DONOVAN. H. Renshaw.

THIS Chart presents us with a view of the classification of the organs, as acknowledged by the best instructed amongst phrenologists. The developments are exhibited, and engravings of the skulls of the Caucasian, the Mongol, the Copt, the Negro, and the Idiot, are given for comparison, whilst likenesses ornament the sheet of several of the most intellectual persons, so that the eye may distinguish those who exhibit the higher range of faculties.

A Commentary on the Eton Latin Grammar. By RICHARD HAYNES. Lloyd and Co.

THIS is a sensible performance, it elucidates the principles upon which Grammar has been formed, and explains many of those points which the student complains of as difficulties. It, however, is scarcely to be called a Commentary on the Eton Grammar, but Means by which the acquirement of the Latin language may be facilitated. The largest portion of the work is devoted to the verb, after a very brief consideration of the other parts of speech, the observations on them not being particularly explanatory of the book which they are supposed to comment upon. The few remarks on the genders of noun substantives, leave that mystery to the young mind much in the same state of darkness that existed before. Upon what principle the ancients founded their assignment of genders to inanimate objects remains a matter of investigation, and probably our author has thought such an inquiry would rather tend to draw attention from the other peculiarities of construction of the Latin language. He has pointed out with great clearness that much of the scholar's time is wasted in burthening his memory with useless repetitions, and exemplifies it in the unnecessary separation of the declensions of adjectives from those of substantives; he shews the incorrectness of grammarians in speaking of three degrees of comparison. Orthography and Etymology are the sections he has discussed, and we hope he will continue his labours on Syntax and Prosody.

A Dictionary of Archaic and Provincial Words. By JAMES ORCHARD HALLIWELL, Esq. John Russell Smith.

THE first number of a Key to the Early English Language is here presented to us, and a valuable undertaking it is, for which we augur success, as much from its utility and from its filling up a blank which has long been perceptible in our literature,

as from the conviction that it is under the control of skilful hands. The provincialisms, quaint proverbs, and fantastic forms of speech which exist amongst us, require research for their explanation, and a knowledge of the many tongues from which our vernacular language is formed, and we are glad that a glossary will soon exist, to which the lovers of antiquarian lore may unhesitatingly refer. Of the variety of purposes to which a single letter may be turned, an example is given in the first letter of the alphabet, which our author shews from various quotations, is used in nineteen different ways; it has been employed for he, for they, for all, for one, for ever, for yes, for and, for in, and for various obsolete expressions, of which we have different examples furnished us.

The Ecclesiastical Antiquities of the Cymry. By the Rev. JOHN WILLIAMS, M.A. W. J. Cleaver.

WE have had occasion to speak of this important addition to ecclesiastical literature as the work appeared in parts, and now that the author has concluded his labours, we have to express the warmest approbation of his zeal, research, and capability of conveying information. The ancient Church of Wales required its historian, and Mr. Williams has shewn that he was admirably adapted for the undertaking. He has not confined himself to the simple enquiry into the introduction of early Christianity into the island, but has described to us obstacles the infant church had to contend with; he has detailed to us the circumstances connected with the Bardo-druidical system, has explained its principles and its government. Acquainted with the language in which for so long has laid buried documents which alone could throw light upon the subject, he has compiled from authentic sources his statements as to the provinces of Britain. The introduction to the work describes the rise, progress, and condition of Bardism, and instructs us that the simple and general statements of Scripture furnish the foundation for conjectures as to the settlement of Britain, and that the best national traditions bear them out. For this he gives us extracts from the historical triads. The Bardo-druidic creed, the theological triads, the moral triads are given to us as illustrations of the singular purity of British Druidism, and as an introduction to the history of the progress of Christianity. This last subject forms the larger proportion of the work before us. To Bran, the father of Caradog, the Caractacus of the Romans, is ascribed the first teaching of Christianity in Wales, and a farm-house in Glamorganshire, called Trevran, is the spot pointed out by tradition as his residence, and our learned author dwells on the coincidences which authorize us to entertain

such an opinion; the oldest church in Britain is not far from it. He traces the missionaries and saints who were spiritual instructors; a chapter is devoted to the establishment of the church, and we have a series of admirable disquisitions upon the foundation and endowment of churches, of dioceses and parishes, of monasteries, and upon all those subjects that are now so generally canvassed, and which have become so valuable since an inquiry into ecclesiastical antiquities is deemed an important duty amongst those who would see the Church of England command the respect and devotion of those who are committed to her charge. Mr. Williams has executed the task which he undertook in such a manner, as to make us feel pleased that he should have been the gleaner in the rich field which others have carelessly passed over, regardless of the useful materials which when properly gathered together, form a rich store from which many may be fed.

A Dissertation on the True Age of the World. By Professor Wallace. Smith, Elder, and Co.

An inquiry into the exact age of the earth is a subject worthy the consideration of minds of the highest class, and demands intellect of no ordinary character. Geography, astronomy, geology, give their different lights to the pursuit, but from the sacred Scripture must be sought the sources of truth. Great are the apparent discrepancies which are found in the present Hebrew text, and the Septuagint version of the Old Testament; Professor Wallace has devoted his attention to the elucidation of the difficulties which presented themselves. The first part of his work embraces a critical analysis of the six ages or subordinate periods into which chronologists have divided the time previous to the advent of our Saviour. 1. The antediluvian age. 2. The post-diluvian age. 3. The patriarchal age. 4. From the exode from Egypt to the foundation of the Temple of Solomon. 5. The monarchial age. 6. The hierarchial age. In the second part, having determined the epochs of the nativity of Christ, the Professor inquires into the records which exist from sacred and profane historians of the prophetic announcement, and this leads him over a wide field of inquiry, which embraces matter of the most interesting character. The multitude of discordant dates which overcloud the subject, has not prevented him from shewing that a clear and united testimony may be deduced to the authenticity of the computation of the Septuagint. He draws his inferences that the Hebrew and Samaritan texts have been interpolated to serve some particular end or design, but that the Septuagint bears with it evident marks of genuineness and authenticity. Professor Wallace has conducted this inquiry with considerable research, and an anxious wish to ascer-

tain truth, and we shall look forward with anxiety to the publication of the astronomical calculations he has commenced, and which promise to be of such importance in the settlement of the disputed questions.

Shepperton Manor; a Tale of the Times of Bishop Andrews. By the Rev. J. M. Neale, B.A.

This is an interesting work, pourtraying a picture of the English Church during one of its most eventful periods. Its relations to the newly fledged doctrines of Puritanism, and to the expiring throes of the Roman Communion, are depicted during the course of a fictitious narrative, in which are introduced, as the acting personages, some of those distinguished men who have left their name imprinted in the annals of their country. Bishop Andrews and Prynne are amongst them, and the author of the tale has painted the features of both with evident judgment, and an accurate knowledge of their characteristics. The scene is laid at Shepperton Manor, where the rector, Dr. Lenton, had acquired the love and esteem of his parishioners by his unaffected zeal and devoted attachment to the Church of England, carrying out to the full all the means she afforded of discipline, prayer, and almsgiving. In his parish resided Sir Thomas Racton, in the language of the times a popish recusant, together with his daughter Catherine, who has imbibed from earlier years, some of the new doctrines. The broad lands of the knight tempt a courtier, Sir Alan Tyringham, to denounce him, and thus obtain a grant of these valuable possessions, and a train of incidents of considerable excitement follows upon the anxiety of the zealous hunter and persecutor of the Catholics to seize a Popish priest, whose nocturnal visits to celebrate the holy mysteries at the manor house, had for some time been eagerly watched. Sir Alan is ultimately successful, he compels Sir Thomas Racton to fly the country, arrests the object of his search, but at the moment of his exultation, loses his life. Upon this thread is woven an ingenious tale, in which some episodes of considerable beauty are introduced, and in various conversations some of the most difficult tenets and views of the Church are in good taste and orthodox spirit elucidated. The journey of the pious rector to preach before the king, gives our author an opportunity of introducing a sketch of those scenes which at that time occurred within the walls of many of our parish churches, the intrusion of itinerant lecturers who, taking possession of the pulpit, vilified the doctrine of the Church, and exalted the Genevan sectaries. We have likewise, several dialogues from the mouths of the eminent churchmen of the day, which, without being controversies,

are clear expositions of the different opinions that existed, whilst the arguments which convert the mind from the Roman Catholic branch to the Church of England, are well exemplified in the language used towards the daughter of Sir Thomas Racton, and which eventually lead her from the errors of her ways to simpler and less superstitious paths. The author has succeeded in his objects to their fullest extent, for whilst his delineation of the memorable characters he has drawn must be acknowledged to be accurate, he has furnished us with an able view of the difference between the Church of England, as far as rites and ceremonies, as she existed in the days of King James, and as she at this moment presents herself to the scrutinizing and jealous eye of those who dread innovation.

The Amelioration of Ireland. W. J. Cleaver.

THIS is the first series of papers designed to promote the amelioration of Ireland; the proceeds of the sale are to be devoted to the rebuilding an ancient church in Ireland. The object of the dissertation before us, is to obtain the translation of the prayer-book into Irish, and to have it thus read in the churches. The author founds his argument upon the 24th article of the English church, which declares, " it is a thing plainly repugnant to the word of God, and the custom of the primitive church, to have public prayer in the church, or to minister the sacrament in a tongue not understanded of the people." It appears from the evidence our author has collected, that both Edward the Sixth and Elizabeth were anxious that ministers should be selected who could speak Irish, and that the first of these monarchs directed that the service should be translated into Irish. The great importance of the subject to which our author has directed his attention, demands a close examination of the remedies with which he purposes to meet the existing evils, and to these, when he has fully developed his views, we hope to return.

The Three Parties; or Things as they are in the Church of England. By the Rev. R. MONTGOMERY. Charles Mitchell.

THIS is an extract from Mr. Montgomery's " Gospel before the Age," which he has republished in consequence of the popularity that he believes his opinions have obtained upon the present movement in the church. His view of the doctrine and practice of that party which he calls the Romanistic, is that the principles on which they proceeded from the beginning are unsound, that the prevailing spirit by which the

greater portion of the controversy has been carried on, has been one which Christianity and the Church must condemn. He sketches the features of the Romanists somewhat in that coarse kind of daubing which attracts the many. He concludes his labours by expressing his opinion, that in their recoil from Geneva they have rebounded very near, and in some cases quite, into the fatal embraces of Rome.

Post Office London Directory for 1845. London. Kelly & Co.

WHAT a mass of useful information is gleaned from every source to render this volume acceptable to the useful classes of society. It is in itself a striking proof of the progress of the commerce, the wealth, and the industry of the country, it speaks of progress in every page, it shows what a multiplicity of wants artificial society creates, and tells us where every thing is to be found; it is the best guide through the mazes of the mighty Babylon. Mercantile, commercial, literary men, may alike find in this great compilation information the most valuable to them; it is not only a Street Directory, such as was formerly annually sent out to the few who required such assistance, but it is a serviceable guide in every branch of business, in every occupation or profession in which men are employed. There can be no doubt that the enormous expense of the spirited proprietors will be amply rewarded, for no one can be a man of business without having within his reach this manual of usefulness.

NEW MUSIC.

Cathedral Chants. Edited by ED. RIMBAULT, LL.D., F.S.A. London. D'Almaine and Co.—This collection of Cathedral Chants, of the last three centuries, will prove valuable to the amateur, both from the intrinsic merit of the subjects and from the care of the editor. Dr. Rimbault is known as an ardent musical antiquarian, in whose sound knowledge and research the less inquiring may safely confide. In the work before us will be found satisfactory evidence of this assertion. The chants have been gathered from the best sources, from cathedral and collegiate libraries, revised strictly, and their original harmonies restored, where modern corruptions had crept in. A premonition upon the art of chanting has been appended to the editor's preface, which may be read with advantage by all who are concerned in the musical service of the Church of England. Dr. Rimbault has given a short biography of the composers upon whose stores he has drawn, and has presented to the public a

work no less ornamental in form than valuable in matter. In the sixth line of the "Directions for Chanting," the word *psalm* is used instead of *verse*. The ornamental illustrations display considerable taste; the border embracing each page is taken from a MS. set of part books, formerly belonging to the chapel of Edward the Sixth; and the ornament on the binding is from the ancient seal of the See of Canterbury.

The Mount of Olives. (Oratorio). Composed by LUDWIG VON BEETHOVEN; edited by Sir H. R. BISHOP. D'Almaine and Co., Soho Square.—The growing appreciation of the works of Beethoven has led to the publication of the present edition of the great work now before us. Four and forty years have elapsed since its first production, and every succeeding performance of it has tended to establish it still more firmly in the affections of the public. It has been before translated into English, and edited by Sir George Smart, and by Mr. Oliphant. It has been performed at Exeter Hall, and in other choral societies, under the title of "Engedi," of which adaptation of the original we have before expressed an opinion, which we need not now repeat. It may, perhaps, excite some surprise that a work, the career of which has been so progressively successful, should be found so rarely in those private circles where the best class of music is sought out and cultivated; the impediment to its introduction in such parties may be discovered in the *personal* character of the words, in which the language of Scripture is constantly, and not always successfully, or reverently mixed up with the conceptions of the author of the poem. The German taste admits of this mode of handling sacred subjects, whilst the English recoils from it. Mr. E. Taylor, in editing Spohr's "Crucifixion," felt himself compelled to adopt a course in unison with this national feeling, under which the original aim of the author was considerably modified. Had we time, we might show from a multitude of instances how far this feeling of *personation* affects the production, in private, of many of the most beautiful compositions, both sacred and secular. So far as these scruples are referable to a deep and reverential feeling, they are entitled to our respect and recognition; but there are occasions upon which they provoke a smile.

In contemplating this sacred scene from the holy drama of which it is part, (for it is a scene rather than an independent drama,) we feel this admixture, and regret the effect of it. The scriptural ideas are beaten out until their solid gold becomes a mere tinsel; nay, sometimes the original ore is subducted, and the *Deutsch* metal of the Poet is openly substituted for the gold of the Evangelist. This cannot but offend the English amateur, who, while looking in vain for the primitive beauty of holy writ, or the inspired dignity of Milton, will find himself reminded of the flippant jinglings of the German operatic muse.

The author of the translation of the "Mount of Olives" which has been employed by Sir H. Bishop, has very unnecessarily deprecated the severity of criticism upon the score of the difficulty of preserving rhythm in language co-ordinately with the notation of Beethoven, whose text has been *but in one instance changed;* were we disposed to neglect this appeal, we might be led to ask whether it was necessary to sacrifice grammar, as well as rhythm? But we will be tender, and merely recommend to Mr. Bartholomew a mild course of Lindley Murray. Of the musical editor's duties we can speak most favourably. The intricate symphony with which the oratorio commences is set before the pianist with all the distinctness of effect which it is possible to impart to it upon that instrument. The accompaniments throughout are brought well under the hand, without losing any of the character of the passages by enfeebling transpositions. In the chorus of soldiers, (p. 35,) we miss the second tenor part in the accompaniment; we have not the score at hand, but we are inclined to think that it is embodied in the orchestral parts. This deficiency, which does not, however, impair the effect, can be easily supplied by the player. A great feature in this edition, which will not escape the attention of the amateur, is that the *bowing* is carefully marked; so that due justice may be done to the pointed emphasis of the composer's phrases, or the default must rest upon the performer, not upon the editor, to whom we tender our acknowledgments of the service which he has rendered, in this additional instance, to the progress and establishment of sound musical knowledge and purified taste.

FINE ARTS.

GOETHE.

THE inauguration of the statue of Goethe took place at Frankfort, on the 23d of October. It is the work of the famous sculptor Schwanthaler; is of bronze, and colossal, and exhibits the poet standing erect, with his eyes cast upwards, and his features expressive of the most profound meditation. It is treated with the ordinary modern costume, assisted by the ample drapery of a mantle. His right arm rests on the trunk of a tree, and in his left hand, which is by his side, he holds a laurel crown. The four sides of the pedestal are ornamented with bas-reliefs, three of which are compositions embodying the principal characters in his works, and the fourth, being the face of the pedestal, contains three figures impersonating natural science, lyric poetry, and dramatic poetry.

CHARLES KEMBLE.

An admirable bust of this gentleman has been placed in the Manchester Athenæum. It is by Mr. Butler, in the New Road, and in character and severe chastity of style, reminds us of some of the best works of antiquity. The expression given to the features is of the most searching intensity; hence we may suppose the distinguished actor in the severest vein of some one of his favourite and popular characters.

THE FRESCOES.

It is stated in the German journals, that Lord Palmerston, during his stay at Berlin, had a long conference with the celebrated German artist, Cornelius, relative to the decorations of the New Houses of Parliament. Cornelius, it may be remembered, was in this country a year or two ago, by invitation of members of the Fine Arts Commission, who were desirous that he should decorate the Houses of Parliament.

ANTIQUES.

M. Lebas, of the French Institute, who has been for two years engaged in a scientific mission in the East, is about to return to France with some valuable ancient sculptures, and upwards of 500 drawings of ancient edifices, bas-reliefs, &c. In addition to these, he has collected about 4000 inscriptions, more than the half of which are as yet unpublished, and has succeeded in effecting their restoration by supplying the blanks.

MICHAEL ANGELO.

It is stated in the *Revue de Paris*, that General Ramigny has become the possessor of a head of extraordinary beauty, by Michael Angelo. It was discovered among some of the panelling of a chateau near Valenciennes, of which he is the purchaser.

THE DECORATION OF THE ROYAL EXCHANGE.

At this time, when on the part of the Government, and the acknowledged patrons of art, professions are rife and emphatic in favour of the amelioration of our own school—at this time we are disposed to look narrowly at effort, as well on the side of the patron as on that of the painter,—in the hope of learning that each is worthy of the other. The measures which have hitherto resulted from the labours of the Commission of Fine Arts, in respect to the decoration of the Houses of Parliament, are distinguished by wisdom and unexampled liberality, insomuch as to throw every other competition into shade. Thus it would be supposed that the judicious progression of the commissioners might in some sort have served to guide other bodies, (although, of course, acting upon a very reduced

scale,) to whom it might be confided to determine in what way a public edifice should be decorated. The example has, however been lost upon the city authorities, who have employed the German artist, Sang, to decorate the Merchants' Area of the Royal Exchange. A rude taste is always fascinated with a glare of crude colour, a fact which Sang has well turned to account, in his dealings with the city: his proposition to arabesque the Royal Exchange in the manner it has been done, was made with a full knowledge of the low standard of taste among us. We require, it is true, a chaste decorative style, but surely a temple of commerce, whose oracles are heard at the extremities of the earth—whose priests are potentates, swaying the destinies of millions of subjects, is worthy having something more than impossible associations of heads and tails painted on its walls. With our millionaires the adequate and appropriate finishing of the Exchange has undoubtedly been a thought far below the merest chink of daily discounts and premiums, and not to be spoken of with the sugar and rum of the West, the hides and tallow of the North, or the rice, indigo, and spices of the East and South. Thus that kind of refinement which readily made its way among the merchant princes of Venice is not considered among the merchant princes of London. It is enough that they look to the shell of their place of assembly—the rest may look to itself, and the result is, in some degree, such as might be expected by ordinary observers, but to those who canvas more closely circumstances as they arise, the whole affair of the painting of the Royal Exchange is a painful anomaly, a direct and gratuitous dissent from the public voice, which is everywhere heard in favour of sterling art, not only in the capital but in the remotest parts of the kingdom.

There are many methods of painting adapted to mural decoration, as tempera, encaustic, fresco, and ordinary oil painting. The last is a modern invention, and was first employed in the execution of moveable works—the three others were known to the ancients. In many of the public edifices of Paris and Munich, encaustic has been much employed as well in decorative painting as in sacred history—and that is the method which Sang has employed at the Royal Exchange. The practice generally pursued at Munich is to coat the wall with a composition, consisting of three parts of sand and one of lime, after which, the surface, while yet wet, is rubbed with a linen cloth for the purpose of procuring texture in the ground. For small walls, ornaments, &c., it is necessary that the ground be smooth, therefore instead of sand finely pounded, white marble may be used, and when the composition is applied to the wall, it will in this case be left perfectly smooth. The encaustic vehicle is thus prepared.—To one pound of rectified spirit of turpentine, add half a pound of Damera resin, and a quarter of a pound of wax. The resin should be pounded to powder, and the wax

cut up in small pieces. Both are then put into an earthenware or copper vessel, and the spirit of turpentine poured on them. Place the vessel on a moderate charcoal fire, so that the solution may take place slowly. When the ingredients are dissolved, the vehicle is ready for use, and should be kept in a glass bottle, well stopped, to prevent the volatile oil from escaping. Should the mixture become too thick, spirit of turpentine may be added. The colours are ground in such a quantity of this vehicle as may be necessary to saturate them. If during the grinding the pigments tend to dry, spirit of turpentine should be added. In extensive paintings, the colours are kept in glass vessels, but for smaller works they may be tied up in bladders, like colours for oil painting. The same colours which are used in oil may be employed in encaustic painting. When the surface intended for the painting is perfectly dry, it is washed over with milk, after which, being again quite dry, it receives a coat of encaustic colour of any tone suitable to the proposed work. This is then allowed to harden, in order that it may not be disturbed by subsequent operations, after which it is ready to receive the design. The coloured grounds upon which ornaments are executed, is composed of two or three coats, each of which is permitted to dry before the surface is again touched. The time necessary for the drying of the ground is indefinite. This depends upon the weather; one day is sometimes enough, but it is better to ascertain this by the application of a little spirit, by which, if the colour be moved, the surface is not yet sufficiently hard.

It is to Montabert, the author of the "Traité Complet de la Peinture," that is attributed the suggestion of the revival of wax painting in France and Germany. He recommends it as presenting advantages superior to either oil or fresco for decorative and mural painting; and the difficulties which oppose the study of fresco painting have induced its adoption in France and Germany. Encaustic is also valued by the foreign schools, on account of its permanency, which may be proved by painting with the same colours a given portion of a wall partly according to each process, when a short time will serve to distinguish the methods by the fading of the oil painting.

To proceed to an examination of the painting of the Royal Exchange,—the Merchants' Area is an open space enclosed by a colonnade, the walls and ceiling of which are the decorated portions. The ceiling is divided into compartments by a coffering, in the spaces of each of which are painted alternately a national coat of arms and a small group of unmeaning and common-place objects, inclosed within a mosaic pattern of the most inharmoniously crude and glaring colours. The pith of this pattern is frequently seen on oil-cloth, but in less striking colours; and as regards the little groups, the objects of which they are composed are very faultily drawn, and loosely painted. They are formed, it may be, one of a bee-hive, a rake, and a few

other similarly insignificant components; another, of a boat, with appurtenances appropriate and otherwise. Such is the style of composition which is deemed sufficient for the place of meeting for the greatest commercial power that the world has yet known. The walls are covered with a modification of the florid arabesque, which has been copied now for three hundred years from those of the pupils of Raffaelle. Here and there a naked female half-figure, terminating in a green and pink florid tail, wrought into character with the *lusus naturæ* vegetation by which it is surrounded; and at intervals, the kernel round which the whole has grown, in the shape of a tablet, with nothing on it. The female heads are the same which were designed perhaps by Giulio Romano round the composition called Raffaelle's Bible, and the rest is made up from the arabesques of Perino del Vaga and Giovanni da Udine; but allowing these works their full measure of merit, they are by no means adapted to the decoration of the Royal Exchange. It has often been our fate, in matters of taste, when in our simplicity we would have something of uncommon excellence, to be cajoled into receiving the refuse, the *caput mortuum*, from the selection of our Continental neighbours. If copies of the period of the Roman school were determined on, it had been infinitely better to have given us something in the way of the admirable chiar' oscuro of Caravaggio, which must have suited in some degree with the gravity of the genius of the place; but this, it is evident, the artist could not do, nor would it have answered certain other purposes to which it is presumed the present style may serve. A facility in the composition and execution of this arabesque is readily acquired; the materials are always the same, and they are capable of every kind of modification; hence the abuse of this manner of decoration, which has in Germany and France descended to the coffee-houses, billiard-rooms, and the mean outdoor pavilions of the inns and wine-houses, sometimes designed and painted in the usual way on the walls, and at others stencilled and laid on in the manner of paper-staining, in oil and distemper. Our neighbours make the most of their history in their public monuments, and the little that we have done in this way has been forced upon us by their example; but notwithstanding this, and our abundant subject-matter, we often take up our story at the wrong end. With our solid reputation, it would not be becoming to imitate some of those who vaunt themselves high beyond the limit of truth, since our history, in its simplest narrative, affords material sufficient to support us in comparing notes with any other nation. Let us for a moment suppose the French in our position with respect to commercial relations, and the question of the decoration of a new Exchange to be agitated in Paris; it cannot be believed that they would content themselves with a style of art utterly inconsonant with their edifice,—with painting which literally means nothing, in

a place abounding with the proudest associations in their national annals. If we look at the French national monuments, we find in them that nothing is forgotten; they relate even more than other nations can remember, and moreover every thing is done as worthily as circumstances permit. We may observe, also, the want of accordance between the sculpture placed in the area; we mean that the statues do not assimilate in style; there is, for instance, the old statue of Charles the Second as a Roman emperor, in the right-hand niche, and upon the other side that of Elizabeth in the costume of her time; and not only do these statues disagree in style, but also in size; that of the queen being much larger than the other. Again, the Charles is, we believe, of marble, which it is intended *to paint*, if this be not already done, while the Elizabeth is carved from a sand-stone found at home. The difference in the size of these two works is conspicuous in the niches which they occupy, inasmuch as the Charles is too small, as is the other figure in some degree according to the usual proportions of the niche and the figure. These discrepancies are much to be regretted; nothing could be in worse taste than to place the old statue in the Merchants' Area, since in no one particular does it harmonize with any thing around it. The statue of Elizabeth is executed by Mr. Watson; it stands about eight feet high, and is freely and broadly sculptured in the fashion of her time. That of Victoria, by Mr. Lough, intended for the centre, is also a work of high merit, and a striking resemblance. The statue of Sir Thomas Gresham, by Mr. Behnes, which is intended for another part of the Exchange, has been executed after authentic portraits; the costume is composed of the doublet, hose, mantle, ruff, and velvet bonnet of the Elizabethan period, and the chin is garnished with the prevalent pointed beard, which drops on to the upper part of the doublet; the whole admirably representing a grave elderly gentleman of those times.

SCIENTIFIC MEMORANDA.

TO THE EDITOR OF THE POLYTECHNIC REVIEW.

SIR,—The accompanying plan and description of a self-registering wind and rain gauge, which I have contrived and had in operation for a year, are much at your service, should you think them worthy of a place in your valuable publication.

I am, &c.

WILLIAM FOSTER.

Stubington, Fareham, Hants,
Oct. 1844.

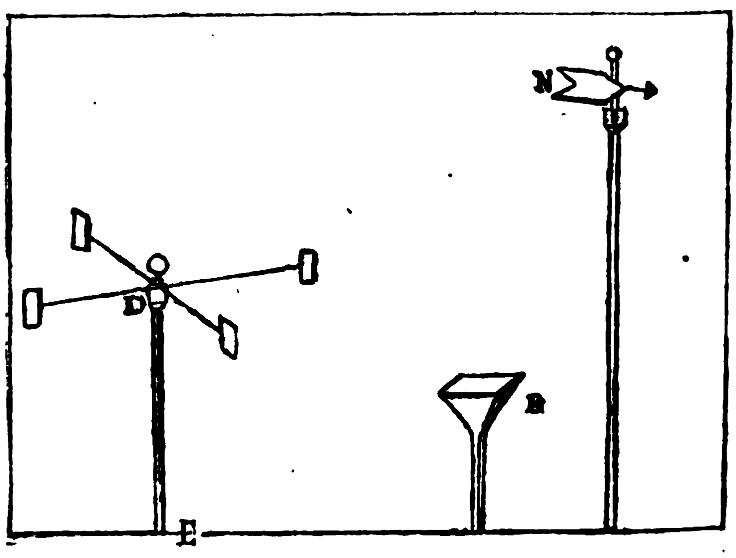
P.S. The instrument was made for me by Mr. Jamieson, St. Mary's Street, Portsmouth, to whom I am indebted for several useful suggestions as to its construction.

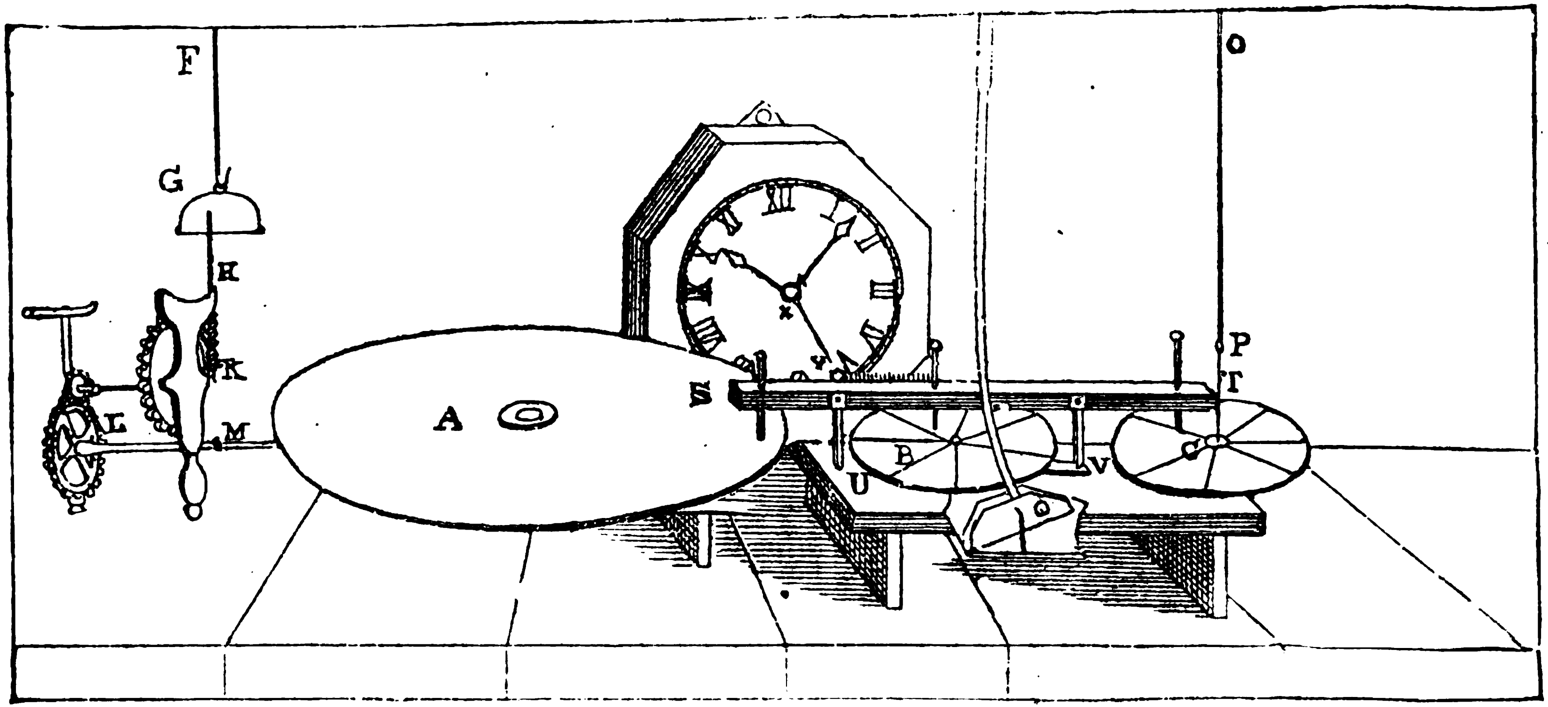
Description of a Self-Registering Wind and Rain Gauge.

A, B, and C are three discs: A, for registering the velocity of the wind; B, the amount of rain; C, the direction of the wind. A is twenty-two inches in diameter; B and C, each nine inches. This part of the instrument is placed upon a table, in a room, and connected with vanes D and N, and a receiver, R, which are fixed outside the roof.

Apparatus for registering the Velocity of the Wind.

D E is a hollow iron rod fixed to a beam of the roof; on the top of D E, and on a centre in the box D, which is well supplied with oil, a fly revolves, whose diameter is three feet, and which carries round with it the rod F G. By means of the endless screw H K, and the wheels on which it acts, the spindle L M is made to revolve *once* for every forty-eight revolutions of the fly. L M turns another endless screw and wheels (not seen in the plan) which are placed under the disc A, and so adjusted that A revolves *once* for every 27,684 revolutions of the fly. Hence, assuming, as is found to be the case, that the velocity of the fly is some function of that of the wind, the movement of the disc in any given time will indicate the amount of wind during that time. The fly is made of iron, and as light as is consistent with sufficient strength; at the end of each arm is a stop, of the form >; and within each stop there is fixed a vane of the form ꟼ. The vane is six inches square, and moveable about a vertical axis. By this means, the fly will always revolve in the *same* direction, from whatever quarter the wind blows.

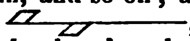



F
G
H
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A
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T
B
U
V
C
Q

Apparatus for registering the Direction of the Wind.

N, an ordinary vane, is connected by the rod O P with the disc C.

Apparatus for measuring the Amount of Rain.

Q is a vessel divided into two compartments, and movable about a horizontal axis. The rain falls from the receiver R down the conducting pipe, and, as soon as one compartment of Q is filled, the gauge tips over; the other compartment then fills, and the gauge tips again, and so on; and by means of an axis with arms, of the form , which arms act at each tip on a toothed wheel, placed under B, B moves about its centre, through a certain space, for every tip of the gauge.

Apparatus for obtaining an Hourly Self-Register.

S T is a light wooden rod, carrying three pencils, one over each disc, and moving on friction rollers, which are placed on the top of the small pillars U and V. On the top of S T there is placed a brass rack with twenty-four teeth; and to the clock there is attached the arm X Y, of the form , with *one* tooth only. X Y revolving once every hour, the tooth acts *once* every hour for about five minutes on the rack, and moves the rod S T and pencils forwards one-sixth of an inch. The rod and pencils are stationary for an hour, and then the same motion forward takes place, and so on, for twenty-four hours. The rod S T is moved back once in the twenty-four hours, which is the only attention the instrument requires.

The combined motion of the pencils and the discs will evidently give the hourly amount of the wind and rain, and the direction of the wind.

The several parts of the instrument are made independent of each other; and with a spare fly, in case of any injury to the fly, the instrument may be kept uninterruptedly in operation.

CONCUSSION SHELLS.

THE RECENT EXPERIMENTS WITH CONCUSSION SHELLS AT PORTSMOUTH, AND WITH PERCUSSION SHELLS AT WIMBLEDON AND AT FULHAM.

THE civilized world appears engaged at the present day in improving their shells. We recorded last month the successful experiments of the French Government with their percussion: our own Government has since carried on an extensive series with the concussion at Portsmouth. The Swiftsure, an old hulk of 74 guns, has been anchored at 1600 yards as a mark, the shells of Captain Norton have been fired first; the first day's experiments were very successful, a number of shells struck the vessel, and inflicted considerable damage; the next day the same shells, fired from the same guns, were very unsuccess-

ful, and since then the results have shown every possible variety—some have exploded on striking the water, while others have withstood that blow; some have exploded in the air from the shock of firing, while others have not exploded at all; shewing that a combination of circumstances is required for the certainty of these shells, even when recently prepared, and that as one or other of these are wanting, the explosion at the mouth of the gun, or their non-explosion, occurs. This shows how far even the most successful of the inventors are from having attained the perfection which the concussion shells of the French Government afforded, they answered perfectly, till they had been submitted to the test of exposure to the damp air of the sea coast; it was then found that they were unserviceable, scarcely one answering, while those fitted upon the percussion principle had sustained no change. The second day's experiments with Captain Norton's being so unfavourable, after the success of the first, would show that even twenty-four hours' exposure exerted a deleterious action on them. The reporter details the destructive effect of these shells as peculiarly terrific; but for this they are not intended, nor indeed could they have any advantage over the shell of the service; they are made of the same iron, of exactly the same thickness, and charged with the same weight of powder. The plan of loading shells with nails and old pieces of iron has been long since abandoned, the powder was mixed with them, and could therefore exert but a very slight force on them as projectiles; but the iron case of the shell, about one inch and a quarter thick, being broken into numerous jagged pieces, and thrown thirty or forty yards, inflicts most formidable wounds; the advantage to be derived from the concussion is from the burning fusee being driven by the blow into the shell, instead of as now, burning into it. This, in the shells of Captain Norton, is effected by a small bar of fusible metal fastening the fusee; this metal, a compound of bismuth, lead, and tin, melts before the heat of the burning fusee, which becomes thus unconnected, and therefore drives in when the ball strikes; but, however beautiful the theory, in practice it unfortunately fails, and when fired at short distances, the fusee is very often extinguished by the blow. Any shell bursting amidst crowded decks would cause great destruction, but that a vessel would be so injured by the explosion of a single shell so as to sink, or to become unmanageable, is absurd; and the writer of the reports must have felt some difficulty in recording the injuries inflicted on the hulk, by the 60th and 70th shell, when one was described as sufficient to destroy it. Other inventors are to succeed Captain Norton,—Colonel Dansey, and Mr. Marsh, the inventor of the test for arsenic. Colonel Dansey is an officer of the Royal Artillery, and a member of the Select Committee at Woolwich, to whom all inventions have to be referred. His situation must have afforded him the rather unfair ad-

vantage of examining in detail, the various inventions submitted to the Board; and it is certainly surprising that, constituted by Sir George Murray as a judge, he should be allowed to enter the lists as a competitor. Mr. Marsh, the Government chemist at Woolwich, who has also from his official situation enjoyed certainly every advantage, has also invented a concussion shell, like that of Colonel Dansey, varying in some unimportant particulars from that of Captain Norton, to whom, or to Sergeant Ormerod, the credit of this suggestion should be given; but the impossibility of their ever being able to resist the sea air, and therefore to stand the sea service, divests the experiments with these shells of much interest. The percussion shells recommended by the French Government, but which, for some perfectly inexplicable reason, Sir George Murray has set his countenance against, have unluckily found supporters in the Duke of Normandy and Mr. Buckingham. Mr. Buckingham, assisted by Professor Ryan, performed some experiments at Wimbledon; his shells were by some peculiar principle to explode at given intervals, varying from a quarter of an hour to twenty-four hours, the blow from the explosion of the powder of the gun igniting some substance, which should burn slowly as touch paper, and it was also stated, that different points of ignition could be obtained by varying the position of the ball, which was surrounded with igniting points of different lengths.

Professor Ryan could have at once informed this gentleman that all such complicated powers would be useless to the service. During the hurry of an engagement, the sailors would be little likely to vary the positions of the ball, and even if they could, under no circumstances would any other power than that of explosion by percussion be useful. The delay of the explosion would merely enable the party attacked to throw into the sea every shell as it struck. The sequel of these experiments was however tragic; one of the shells fired to explode at a quarter of an hour, had remained without any apparent change for several hours. Professor Ryan had examined it, and had numbered it as having failed; a man named Taylor, on washing away the mud, probably shook the powder on the ignited particles, and the shell immediately exploded, maiming the poor fellow for life. Mr. Buckingham applied to the Police Office for assistance to recover the remaining shells, amounting to eight or ten, which had not exploded at the time appointed, and which even the horror of such an accident had not prevented from being dug up and used for knocking down nine pins; one, to decide a bet, had been even put upon a fire. Government had no connexion, as stated, with this experiment; and it is a curious proof of Professor Ryan's absence of personal fear to have superintended such dangerous experiments, as he must have remembered that a Russian General, two years back, lost his life from a shell,

believed to have failed, exploding sixteen hours after firing. Mr. Marsh's concussion shells have thimbles filled with meal powder, fastened with marine glue. He depends upon the heat of firing to melt the glue. This would appear at first view to be impracticable, but some experiments at Woolwich shewed a success equal to that of Captain Norton's. The Duke of Normandy has, he declares, the power of deciding whether his shell shall fire at the first or at the second blow. Now the second blow could never be required unless the Duke studied the interests of the enemy, who, using the shells fired against them, could avail themselves of the explosion at the second blow. This, however, was proved by a shell exploding by a weight falling on it. Now whether the detonating cap was put on at the time agreed for firing, or, as was ingeniously suggested on the ground, at the blow agreed to fire it, the communicating passage was opened, is uncertain. The rocket exhibition was extremely injurious, the Duke claimed the power of making them go straight without sticks, and this was shewn by their being guided along a wire, as in the rockets called the "Flying Pigeon." If an enemy could be persuaded to allow the fixing of the wire, the rockets of the Duke would be extremely destructive to them, this slight difficulty is, the Duke must admit, seriously against them. Mr. Southby fired at Woolwich some rockets perpendicularly without sticks. They were kept back till they had attained considerable force, and it was a matter of surprise to the officers, that as accidents were then continually happening at Vauxhall from the falling of the rocket sticks of even the small size of a quarter of a pound, that he should not have made use of some such contrivance. But as Mr. Southby never succeeded in improving their horizontal flight, we need feel but little surprise, that when without the wires, the Duke's rockets went in every direction but the right. These experiments have been conducted without accident, the small scale indeed on which they are tried would appear to preclude any, but it is this which renders them, as experiments, valueless, as their success from the small blow of a few drachms of powder, would be no test of their withstanding the shock from the explosion of ten pounds, the charge of the gun. The non-recoil principle of the Duke is an absurdity, the force must re-act—there is no recoil when powder for salutes is only fired; the expansion of the powder is checked on one side by the ball which it projects, on the other by the gun which it causes to recoil, and the Duke might as well overturn the laws of gravitation and strike the sun with the rocket, which he says, from London can reach Paris, as overcome this law of nature.

CAPTIVE BALLOONS.

Colonel Sabine has been appointed by the British Association to conduct these interesting experiments at Woolwich. A balloon is to be kept at an elevation of 3,000 feet, and by means of the electric telegraph, daily, or if required, momentary comparisons can be made of the barometric height, the temperature, hygrometric state or currents of the atmosphere in these elevated regions and our own. The balloon by a beautifully contrived arrangement, can be elevated or depressed at pleasure. Mr. Wheatstone has prepared a self-indicating thermometer, barometer, &c., and although those of the Association who always prophecy failures, express their fears that the complicated machinery can never work, and that it will be deranged by oxydization, we are in hopes that we shall by these balloons obtain some knowledge of the atmosphere, of which we at present know so little.

ELECTRIC CLOCKS.

Extract from a letter from Mr. Finlaison, of Loughton Hall.

" I think you will be pleased to hear that Mr. Bain has succeeded to admiration in working electric clocks by the currents of the earth. On the 28th of August, he set up a small clock in my drawing-room, the pendulum of which is in the hall, and both instruments in a voltaic circuit, as follows:—

" On the N.E. side of my house two zinc plates, each a foot square, are sunk in a hole and suspended to a wire. This wire is passed through the house to the pendulum first and then to the clock. On the S.E. side of the house, at a distance of about forty yards, a hole was dug four feet deep, and two sacks of common coke buried in it; among the coke another wire was secured, and passed in at the drawing-room window, and joined to the former wire at the clock. The ball of the pendulum weighs 9 lbs. but it was moved energetically, and has ever since continued with the selfsame energy. The time kept is to perfection, and the cost of the motive power was only seven shillings and six-pence. There are but three little wheels in the clock, and neither weights nor springs; so there is nothing to be wound up. To another friend at Battersea, he has given three clocks, two small ones and one a hall clock, all moved by one current, and regulated by one and the same pendulum. This is all he has completed in England, having just reached Edinburgh, where he is to establish a manufactory of those clocks, which for accuracy, cheapness, and utility, will I believe, surpass every time-piece hitherto contrived."

MESMERISM.

Miss Martineau has announced herself not only a convert to the doctrines of Mesmerists, but a living proof of the power that they assert they possess. She has been relieved by its agency from acute sufferings which for a period of four years had baffled the best medical skill and science. The narrative which she has given to the public, through the medium of the Athenæum, is written with marked evidence of her consciousness of the incredulity with which her statements will be received, but with that simplicity and good sense which do not belong to the deluded enthusiast, nor the careless receiver of uncertain testimony. The difficulty of removing the prejudices which exist against the practitioners who exercise the Mesmeric art cannot be wondered at, when we see the numerous deceptions daily and hourly practised by those who assume to themselves the possession of marvellous functions; and though the belief in the power of producing a peculiar soporific effect upon the nervous system by means generally unknown before, is admitted by many who were the most determined opponents of every thing that bore the name of animal magnetism or Mesmerism, they still repudiate with ridicule or with contempt all those phenomena which have been claimed as having occurred. Miss Martineau has not experienced that sleep which has been more generally admitted to be the sole grounds on which Mesmerism can lay claim to be applicable; but has recovered from bodily suffering, for the relief of which she before had been compelled to have recourse to opium. She doubts its exclusive action on the nervous system, and appeals to numerous recorded cases of the cure of rheumatism, dropsy, cancer, and the whole class of tumours. Of course, her opinions are of no more value than those of any other sensible person, but the facts of which she is a personal evidence are not to be disputed, and they certainly are likely to stagger the understanding of those most determined to resist the novel pretensions of the observers of the phenomena. Although Miss Martineau's narrative is rendered sufficiently intelligible to the general reader, yet it is not so explicit as to enable the physician to determine the nature of the disease under which she laboured; all that is to be collected is, that a deranged state of the functions of the stomach reduced the system to a state of great debility, that discomfort rather than pain was present, and that the exhaustion was of a most distressing character. She was miserably dependent on opiates, and passed her time almost between her bed and her sofa. At the end of four months' trial of Mesmerism, as far as her own feelings enabled her to judge, she was restored, but continued the treatment until her health was completely reestablished. Of the sensations experienced, she gives a detailed description, which at the first were heat,

oppression, and sickness of the stomach, followed in the course of the evening by a feeling of lightness and relief; during the *séance* she did not sleep, but became sensible of an unexpected and perfectly novel appearance; a clear twilight seemed to diffuse itself through the atmosphere, the outline of all objects became indistinct, but dressed in a beautiful light, objects appeared ghost-like, like faint shadows, except that their outlines and the parts in the highest relief burned with phosphoric light; a delicious sensation of ease spread over her, a cool comfort before which all pain and distress gave way. Her first sitting was under the hands of Mrs. Spencer Hall; her maid servant, and afterwards a lady, the widow of a clergyman deeply and practically interested in Mesmerism, became however her constant Mesmerist.

She has related some curious particulars worthy of notice, although the wonders which she expected never occurred. There is much mystery in a description of a peculiar state in which Miss Martineau had some glimmerings of the lights of somnambulism and clairvoyance. She experienced a "state transient and rare, which is uncommunicable partly from its nature and relations, and partly from their unfitness for translation into mere words." This state, which is spoken of as one of repose and of calm translucent intellectuality, resembles that which is experienced by the opium smoker, of whom, we believe, scarcely any exist in this country. As the subject is to be continued by Miss Martineau, we shall have occasion again to revert to a topic which she has invested with peculiar interest, as much from the high character of integrity and virtue which she bears, as from the conscientious testimony which she gives, regardless of the scepticism she may have to encounter.

ROYAL MEDICO-BOTANICAL SOCIETY.

On Thursday the first meeting of the session of the Royal Medico-Botanical Society took place at the apartments in Sackville Street. Mr. Foote, the Secretary, laid upon the table a most munificent donation from the King of the Netherlands; it consisted of a large series of engravings of the flora of Holland, and of drawings, beautifully coloured by Van Blome, of plants hitherto unobserved, growing in the colonial possessions of his majesty. He read a letter from the present King of Sweden, expressive of his feelings towards the institution. Dr. Sigmond delivered the introductory address.

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